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LIGHTING SYSTEM

GENERAL DESCRIPTION

LIGHTING SYSTEM

The headlights are controlled by the headlight control switch, Fig. 12-1, located on the instrument panel at the left of the instrument panel cluster. This switch also controls the parking lights, tail lights, interior lights, license plate light and side marker lights.

The headlights, parking lights and side marker lights operate whenever the headlight control knob is pulled all the way out. The parking lights and side marker lights can be turned on by pulling the knob halfway out. The instrument panel lights can be turned on when the knob is in either position and their intensity can be varied from bright to off by rotating the knob clockwise. The interior lights may be turned on by rotating the headlight control knob fully counterclockwise.

The cornering, parking and front side marker light assemblies are mounted forward of the wheel opening on each front fender. When either turn signal is operating, with the headlights or parking lights on, the corresponding cornering light illuminates the side of the road.

On Fleetwood Eldorado cars, rear side marker lights are located in the side of the quarter panel.

The lane-change directional signal switch is standard equipment on all steering columns. When making a partial turn, such as when changing lanes, the driver has the option of moving the turn signal lever to a detent stop. The signal will

continue as long as the lever is held in this position and will cancel automatically when the lever is released. By using the detent position, a shallow turn can be signaled without a possibility of failure to cancel, if the turn is not sharp enough to do it automatically.

Moving the turn signal lever past the detent position to the extreme of its travel for either turn, will provide conventional turn signal operation.

A Hazard Warning flasher is included in the directional signal switch circuit as standard equipment. Pushing the switch control knob, Fig. 12-2, inward will energize the flasher regardless of ignition switch or turn signal switch position. Pulling the knob outward will cancel the Hazard Warning flasher.

When the Hazard Warning flasher is operating, the turn signal indicator lights and the front and rear turn signal lights will flash. This circuitry disconnects the regular turn signal flasher and substitutes another flasher that is located on the steering column lower cover. The Hazard Warning flasher will operate with the ignition switch on or off. If the brake pedal is depressed while the Hazard Warning flasher is operating, all signal lights will burn continuously.

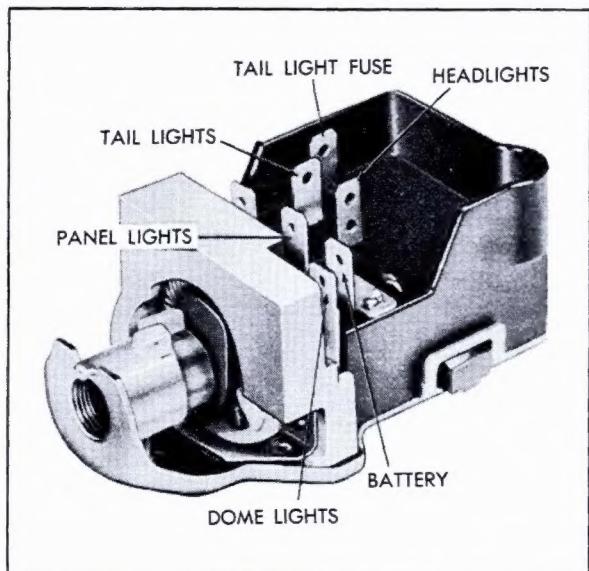


Fig. 12-1 Headlight Switch

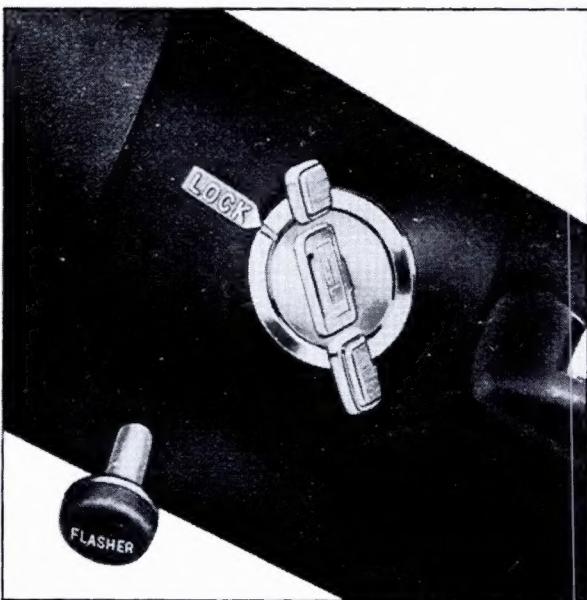


Fig. 12-2 Hazard Warning Flasher Switch

SERVICE INFORMATION

1. Headlight Aiming—Mechanical Aimer Method

a. Adjusting Aimer for Floor Level

NOTE: To obtain accurate headlight aim, the car must be placed on a flat surface.

1. Drive car on selected area and place transit target at rear wheel on either side of car, Fig. 12-3.

2. Place transit at front wheel on same side so target is visible, Fig. 12-3.

3. Adjust screw on back of transit until split image is aligned, Fig. 12-4.

4. Turn dial on side of transit until bubble is centered in level vial, Fig. 12-4.

5. Turn floor level compensator on both aimers with screwdriver until adjoining dial reads same as dial on transit, Fig. 12-5.

NOTE: Aimers must have floor level compensator readjusted for each new location if floor levels are different.

b. Headlight Adjustment

1. Equalize tire pressure as recommended in Section 10, Fig. 10-9, and make certain car is at normal front standing height: Section 3, Note 2 on all but 693 style and Note 34 on 693 style. Make certain car is at normal rear standing height, Section 4, Note 1.

2. Turn on headlight units to make sure none are burned out. All four units should be on for high beam and only the two outer units should be on for low beam. Turn lights off for adjustment.

3. Clean headlight lens. Position aimers on outer headlights. Guide points must engage smooth inner ring of aimer at alignment points, Fig. 12-6 and the "sight" openings on each aimer must point toward center of car.

4. Secure aimer to each headlight by pressing handle "Y" forward until vacuum cup engages headlight lens, then draw handle back until spring catches, Fig. 12-7.

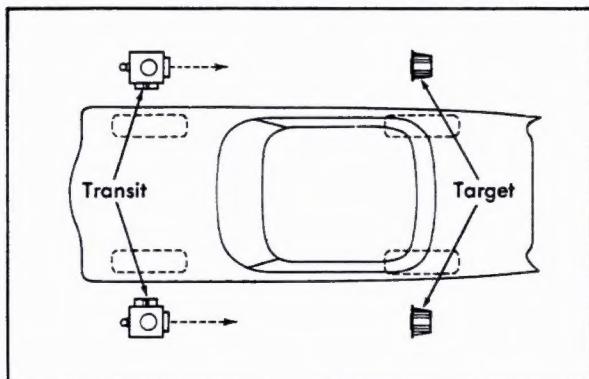


Fig. 12-3 Selecting an Aiming Area

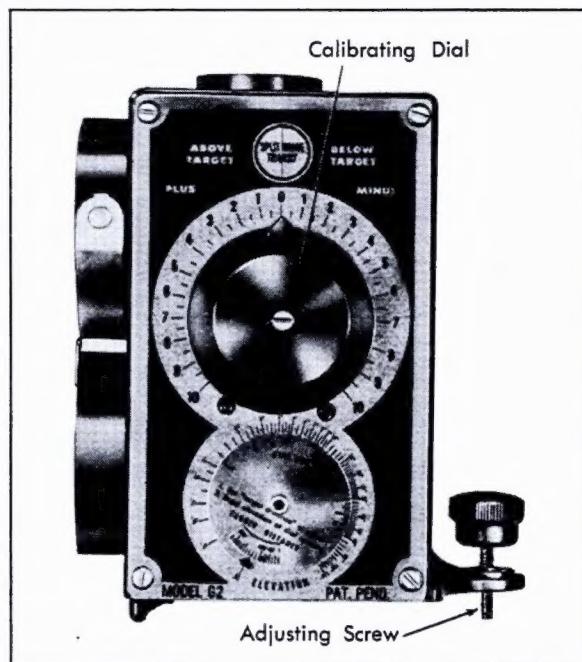


Fig. 12-4 Adjusting Transit

c. Horizontal Headlight Aiming

1. Set "Right - Left" dial on zero, Fig. 12-8.

NOTE: It is not necessary to remove the headlight bezels, as the horizontal and vertical adjusting screws are accessible with the bezels in place on all 1969 Cadillacs.

2. Check split image in viewing port. Rotate aimer slightly if necessary to locate target.

3. If split images are aligned, horizontal aim is correct.

4. If images are not aligned, turn horizontal adjusting screw until split images align. Final

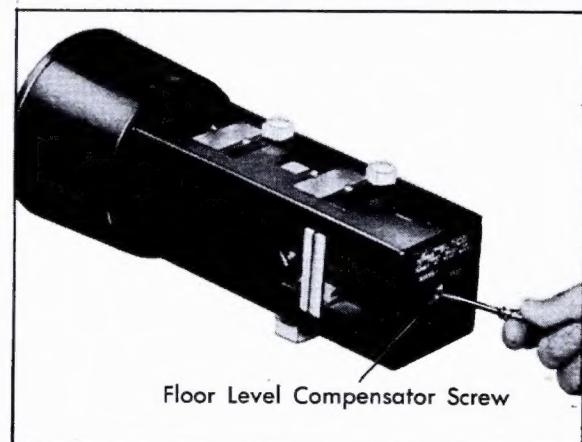


Fig. 12-5 Adjusting Floor Level Compensator

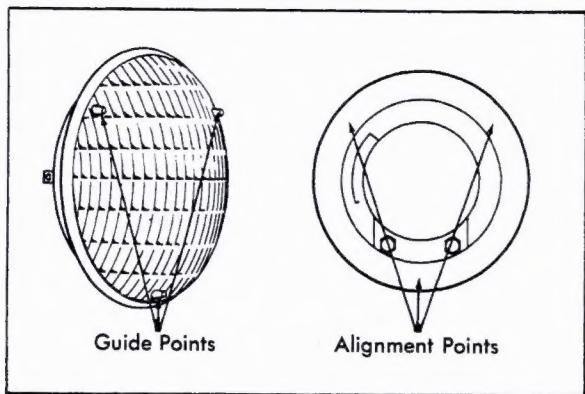


Fig. 12-6 Installing Aimers on Sealed Beams

adjustment should be made by turning screw in a clockwise direction to remove backlash.

d. Vertical Headlight Aiming

- With equipment in place turn knob at "Down-Up" dial until pointer is at "2" down.

NOTE: Individual State laws may vary and dealers should check with local authorities on the regulations of your State.

- Turn headlights vertical aiming screw counterclockwise until bubble is on car side of center. Turn screw clockwise until bubble is centered for correct aim and elimination of backlash, Fig. 12-8. Repeat horizontal and vertical adjustments on other headlight aimers.

- Recheck target alignment on each side and readjust horizontal aim if necessary.

- Hold aimer and release spring catch, Fig. 12-7. Push handle toward headlight to release aimer.

- Repeat horizontal and vertical adjustments on inner set of headlights.

e. Calibrating Aiming Fixture

Aimer, J-6878-01, is calibrated at the factory for use on a level floor. These aimers require no further change in factory calibration unless they are dropped or damaged in some manner.

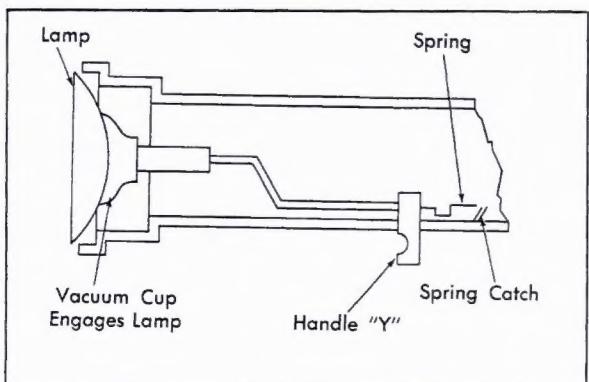


Fig. 12-7 Securing Aimers on Sealed Beams

- With the aid of a good grade carpenter or stone mason spirit level, locate a vertical plate glass window, Fig. 12-9.

- Set "Down-Up" pointer on "2 down". Set "Right - Left" pointer and floor level compensator at "0".

- Secure aimers to plate glass window 3 to 5 feet apart so split image targets can be located in the viewing ports.

- If bubble is centered in vial, vertical calibration is correct. If not centered, refer to Section f of this note for adjustments.

f. Re-Adjusting Headlight Aimer

- With equipment left in place, turn level adjusting screw until bubble is centered on level to obtain correct vertical adjustment, Fig. 12-10.

- Turn mirror adjustment screw until target split image becomes aligned, Fig. 12-11.

2. Headlight Aiming—Screen Method

The factory recommended headlight aiming specifications for the screen method are listed below. However, individual State laws may vary and dealers should check with local authorities.

a. Screen Diagram

Make a headlight aiming screen according to the dimensions and layout shown in Fig. 12-12.

b. Equipment Set-Up

Make sure headlight aiming screen is mounted at a point where there will be an ample level area in front of screen. It is important that floor at aiming screen is at same level as the floor at the point where car is positioned.

c. Headlight Aiming Adjustment

- Position car so that headlights are exactly 25 feet from aiming screen and car is in line with centerline on screen. To position car, sight through rear window, lining up centerline of rear window reveal molding escutcheon with inside rear view mirror bracket and car centerline on screen.

- Position two 36 inch sticks vertically at the left front and left rear wheels. Sight over sticks and move left side of screen up or down, as required, to line up horizontal headlight centerline on screen with the 36 inch sight line. Follow same procedure on right side.

- Mark wall adjacent to horizontal centerline of headlight line on aiming screen. Subtract the curb height from 36. Using the new dimension, mark down on the wall from the 36 inch mark.

Move screen down until horizontal centerline of headlight is even with this point.

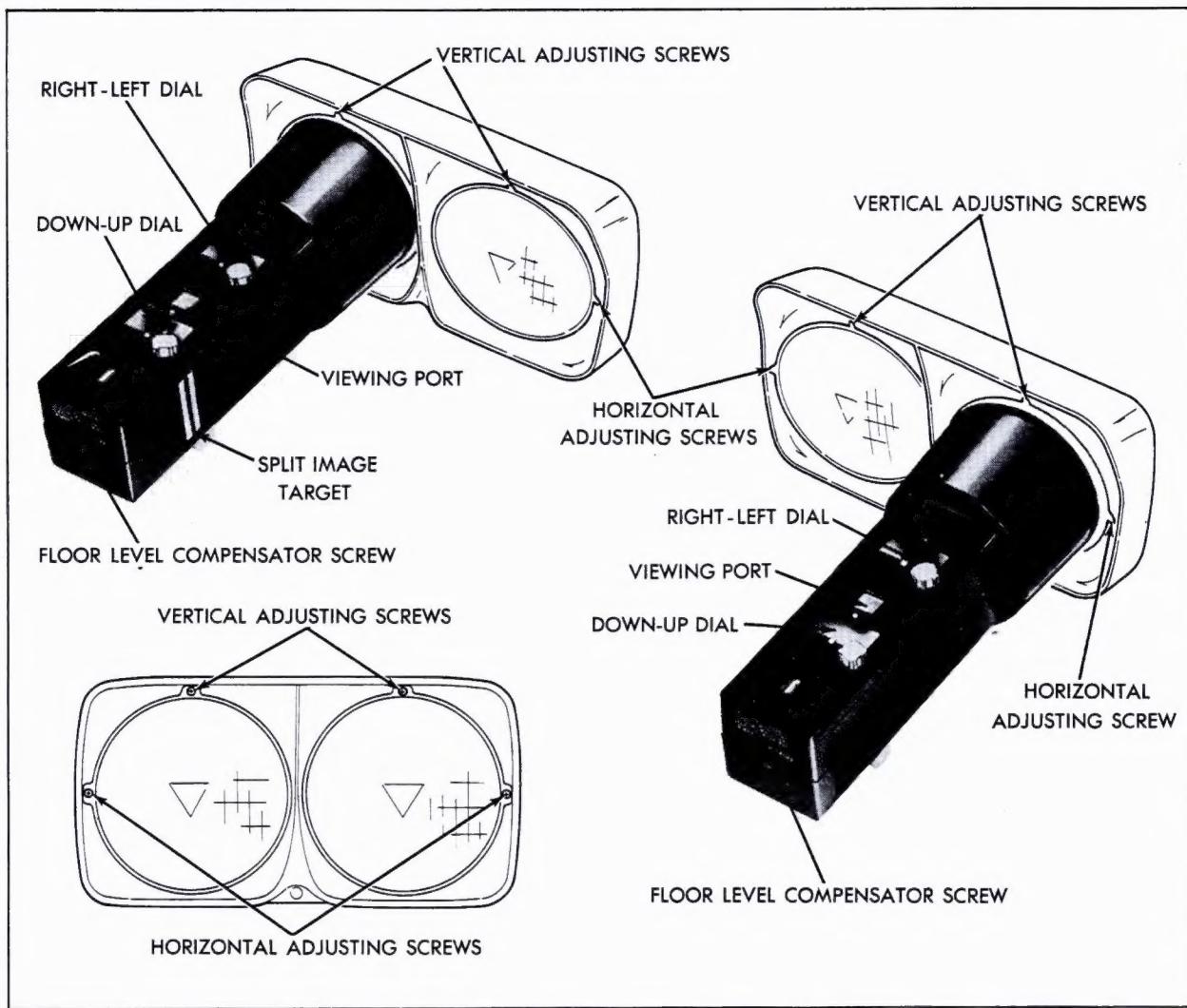


Fig. 12-8 Horizontal and Vertical Adjustments

Series	Rear Suspension	Curb Height
680, 681	Std.	25-7/8
	A.L.C.	25-7/8
682, 683	Std.	25-1/2
	A.L.C.	25-3/4
697	Std.	26-13/16
	A.L.C.	26-13/16
693	Std.	26-1/2
	A.L.C.	26-1/2

4. Set headlights on high beam. Make sure all four headlights are on.

5. Cover both left side headlights and right side outer light and adjust right inner light as required until hot spot centers at point "B" on screen, Fig. 12-12.

6. Cover both right side headlights and left side outer light and adjust left inner light as required until hot spot centers at point "C" on screen, Fig. 12-12.

7. Set headlight on low beam. Only outer headlights should light.

8. Cover left outer headlight and adjust right outer light as required until top of hot spot "D" is on horizontal centerline of headlight and left edge of hot spot is on vertical centerline of outer light, Fig. 12-12.

9. Cover right outer headlight and adjust left outer light as required until top of hot spot "E" is on horizontal centerline of headlight and left edge of hot spot is on vertical center line of outer light, Fig. 12-12.

3. Sealed Beam Unit Replacement

1. Disconnect negative battery cable at battery.
2. Remove three screws securing headlight bezel to headlight assembly and remove bezel.

3. Remove three screws securing headlight retaining ring to mounting ring and remove retaining ring.

4. Remove sealed beam unit and disconnect electrical connector from unit.

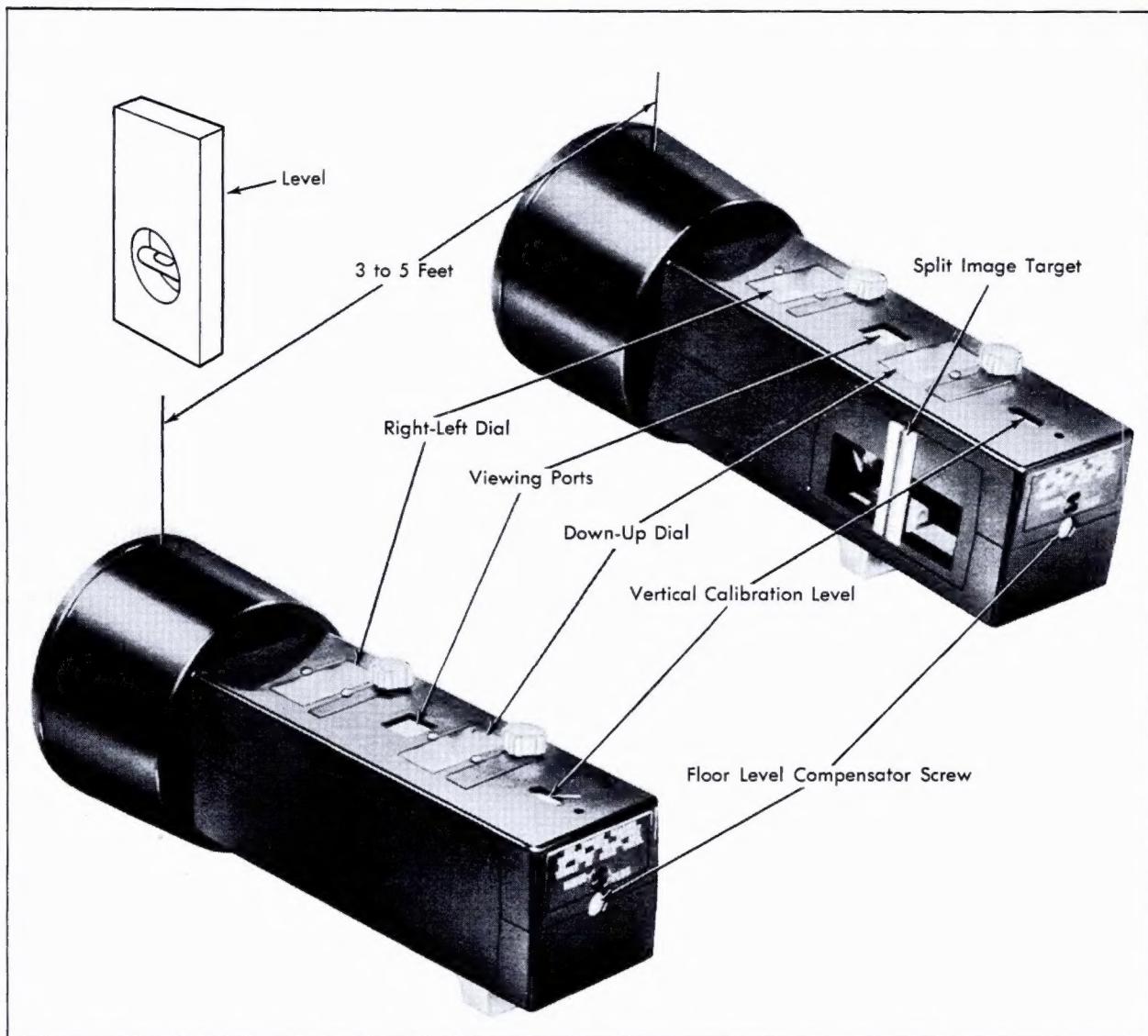


Fig. 12-9 Calibrating Headlight Aimer



Fig. 12-10 Readjusting Vertical Calibration



Fig. 12-11 Readjusting Horizontal Calibration

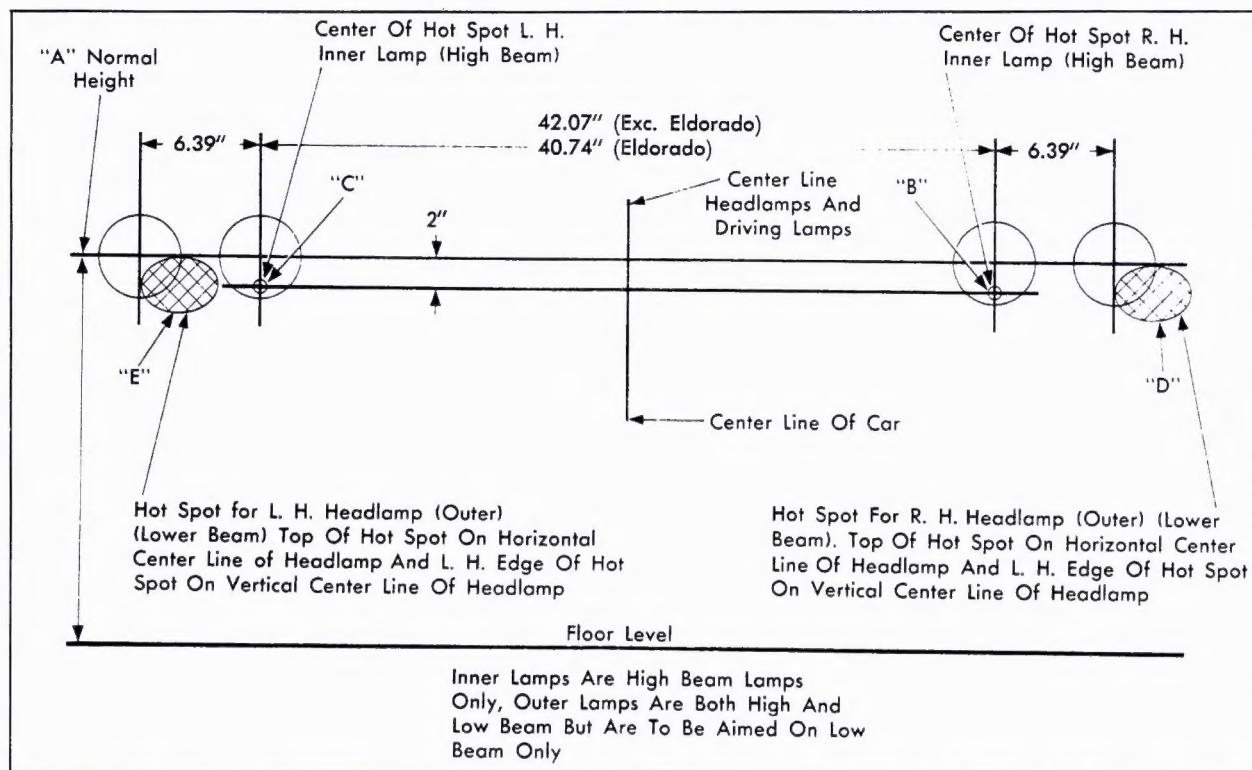


Fig. 12-12 Headlight Aiming Screen

5. Connect electrical connector to new sealed beam unit and install sealed beam unit.
6. Install headlight retaining ring and secure with three attaching screws.
7. Install headlight bezel to headlight assembly and secure with three attaching screws.
8. Aim headlights as described in Note 1 or 2.
9. Connect negative battery cable at battery.

4. Bulb Replacement

A complete list of replacement bulbs for 1969 Cadillac cars is given in the bulb chart, Page 12-11. The procedures for making replacements are outlined in this note except when they are exclusive to the Fleetwood Eldorado, as described in Note 9.

CAUTION: Make certain ignition switch and headlight switch are off when replacing bulbs.

a. Cornering, Parking, or Front Side Marker Lights (All except 693)

1. Open hood to gain access to the lamp assembly.
2. If working on right side of car, remove battery as described in Section 6, Note 18a.
3. Twist socket counterclockwise and remove socket.
4. Install new bulb.

NOTE: The cornering light is clear, while the side marker light and parking lights are amber. The parking light bulb has two filaments, one for the parking light and one for the turn signal.

5. Install socket into housing by inserting and twisting clockwise.

6. If working on right side of car, replace battery as described in Section 6, Note 18b.

7. Close hood and check bulb for proper operation.

b. Rear Back-Up, Tail, Stop and Signal Lamp Bulbs (All except 693)

1. Open deck lid to gain access to bulbs.
2. Pull carpet and liner back to reach sockets.
3. Pull socket out to remove bulb being replaced.
4. Install new bulb into socket and insert socket into housing.
5. Close deck lid and check operation of new bulb.

c. License Plate Light

1. Remove two Phillips head screws securing lens to housing and remove lens.
2. Replace bulb.
3. Install lens with two Phillips head screws and check operation of bulb.

d. Instrument Panel Courtesy Lights

1. Reach under dash and snap socket and bulb out of housing.
2. Remove bulb from socket and replace.
3. Snap socket and bulb into housing.

e. Map Light

1. Remove two screws securing lens to map light housing.

2. Pull lens out at the top and remove lens.
3. Remove bulb from socket and replace bulb.
4. Place lens over housing and secure with two attaching screws.

f. Instrument Panel Lights

1. Remove instrument panel top cover as described in Note 44a.
2. Replace bulb in back of cluster.
3. Install instrument panel top cover as described in Note 44b.

g. Automatic Climate Control or Heater Panel Light

1. Remove steering column lower cover as described in Note 45a.
2. Remove socket from housing and remove bulb from socket.
3. Install new bulb into socket and replace socket in housing.
4. Install steering column lower cover as described in Note 45b.

h. Radio Receiver Dial Light

1. Working under dash, remove defroster hose, on all cars except the Fleetwood Eldorado, to allow access to the bulb.
2. Reach up over radio and snap socket out of top center of receiver unit.
3. Install new bulb and snap socket into radio receiver.
4. Install defroster hose, if removed.

i. Headlight Switch Dial Lights

1. Remove steering column lower cover as described in Note 45a.
2. Pull upper or lower socket from housing and remove bulb.
3. Install new bulb and snap socket into housing.
4. Install steering column lower cover as described in Note 45b.

j. Ash Tray Light

1. Remove ash tray receptacle.
2. Remove bulb socket from shield, replace bulb and install sockets.
3. Insert ash tray receptacle in ash tray housing.

k. Glove Box Light

Open glove box door and replace bulb located just above top center of door opening.

l. Clock Lights

1. Remove clock as described in Note 56a.
2. Replace either bulb.
3. Install clock as described in Note 56b.

m. Cruise Control Selector Dial or Indicator Light

1. Remove instrument panel top cover as described in Note 44a.
2. Snap socket and bulb from selector assembly and replace bulb.

3. Install instrument panel top cover as described in Note 44b.

n. Trunk Lamp Bulb

Open trunk lid and replace bulb located in center of trunk lid.

o. Seat Warmer Tell Tale Bulb (697 Style Only)

1. Disconnect negative battery cable at battery.
2. On cars equipped with Tilt and Telescope steering wheel, position wheel in maximum UP position for greater accessibility.
3. Remove steering column lower cover as described in Note 45a.
4. Disengage telltale socket from lower cover and replace bulb.
5. Position spring and ground washer on socket and install into steering column lower cover.
6. Install steering column lower cover as described in Note 45b.
7. Connect negative battery cable at battery.

5. Cornering, Parking, and Front Side Marker Light Assembly (All except 693)

a. Removal

1. Disconnect negative battery cable at battery.
2. On side of assembly being removed, remove two bolts, flat washers, and lock washers at the inner and outer bumper mounting bars.
3. On opposite side of car, remove two bolts, flat washers, and lock washers at inner bumper mounting bar.
4. Support bumper and loosen two bolts at outer bumper mounting bar. Allow bumper to drop down from fender.
5. Remove one screw securing rubber filler and lamp assembly to fender at front of wheel opening.
6. Remove light sockets and bulbs by twisting bayonet sockets counterclockwise until a detent position is felt.

NOTE: If working on right side of car, battery must be removed as described in Section 6, Note 18a.

7. Remove three screws securing top of lamp assembly to fender and remove lamp assembly.

b. Installation

1. Position lamp assembly to fender and secure with three attaching screws on top of assembly.
2. If working on right side of car, replace battery as described in Section 6, Note 18b.
3. Install light sockets and bulbs into lamp assembly by twisting clockwise.
4. Install rubber filler and secure with one attaching screw.
5. Raise bumper into position and install two bolts, flat washers, and lock washers at each mounting bar.

6. Align bumper and tighten eight mounting bolts to 45 foot-pounds.
7. Connect negative battery cable at battery.

6. Rear Back-Up, Tail, Stop and Signal Lamp Assembly (All Except 693)

a. Removal

1. Open trunk and pull carpet and liner back to gain access to lamp assemblies.
2. Remove two bulbs and sockets from lamp assembly by snapping out.
3. Remove three nut and washer assemblies securing lamp assembly to rear fender. One is located at the top of the lamp and the other two at the bottom.
4. Pull lamp assembly out just far enough so the studs are out of the holes in the fender. Push the assembly straight up until flange on bottom of lamp assembly clears bumper. Then pull the lamp assembly straight out.

b. Disassembly

1. Place tail lamp assembly on work bench and remove three Phillips head screws securing lenses to lamp assembly.
2. Remove gasket and lenses.

c. Assembly

1. Install lenses and place rubber gasket over lenses and housing.
2. Install three Phillips head screws securing lenses to lamp assembly.

d. Installation

1. Position lamp assembly into fender just far enough so that mounting studs are not engaged in mounting holes. Then push up on the assembly until the flange on the bottom of the assembly clears bumper. Push assembly in and locate studs in fender holes.
2. Install three nut and washer assemblies se-

curing lamp assembly to rear fender. One stud is located at the top of the assembly, the other two at the bottom.

3. Install two bulbs and sockets and lamp assembly by pushing in.

NOTE: The sockets are notched so that the bulbs cannot be installed in the wrong hole.

4. Reposition carpet and liner and close trunk.

7. License Lamp Assembly

a. Removal

1. Disconnect license lamp wire connector.
2. Remove two Phillips head screws securing license lamp assembly to center bar and remove.

b. Installation

1. Position housing assembly in center bar and secure with two Phillips head screws.
2. Connect wire connector.

8. Trunk Lamp Housing

a. Removal

1. Open trunk lid.
2. Remove trunk bulb.
3. Disconnect retainer clip from trunk lid.
4. Remove one Phillips head screw securing trunk lamp housing to trunk lid.
5. Remove housing.
6. Disconnect trunk lamp housing black lead wire connector from orange wire connector.

b. Installation

1. Connect black and orange wire connectors.
2. Install housing and secure to trunk lid with one Phillips head screw.
3. Position connector and wiring inside trunk lid and secure orange wire to trunk lid with retainer clip.

SERVICE INFORMATION

NOTE: The service information that follows pertains only to the Fleetwood Eldorado. For service procedures not given here, the procedure is the same as given for other 1969 Cadillac Cars.

9. Bulb Replacement—693

A complete list of replacement bulbs for 1969 Cadillac cars is given in the bulb chart, page 12-11. The procedures for making replacements that are described in this note are exclusive to the Fleetwood Eldorado. In those cases where the procedures for all cars are identical, refer to Note 4.

a. Front Turn Signal and Parking Lamp Bulb

1. Remove two Phillips head screws securing lens to lamp and remove lens.
2. Replace bulb.
3. Install lens on housing and secure with two Phillips head screws.

b. Cornering or Front Side Marker Light

1. Remove cornering and front side marker light assembly as described in Note 11a.
2. Remove six Phillips head screws securing lens to housing and remove lens.
3. Remove bulb.

NOTE: Cornering light bulb is clear, while side marker light bulb is amber colored.

4. Install bulb.
5. Position lens to housing and install six Phillips head screws retaining lens to housing.
6. Install cornering and front side marker light assembly as described in Note 11b.

**c. Rear Tail, Stop and Signal Lamp
Bulb or Rear Side Marker Light Bulb**

1. Working inside trunk compartment, remove screws securing side trim panel and position trim panel away from quarter panel.
2. Disconnect bulb and socket assembly and remove bulb from socket.
3. Install new bulb in socket and connect bulb and socket assembly.
4. Reposition side trim panel and install retaining screws.

d. Back-Up Lamp Bulb

1. Remove back-up lamp assembly as described in Note 14a.
2. Replace bulb.
3. Install back-up lamp assembly as described in Note 14b.

**10. Front Turn Signal and
Parking Lamp Assembly—693**

a. Removal

1. Disconnect negative battery cable.
2. Disconnect electrical connector to parking lamp assembly at radiator cradle tie bar.
3. Working inside of fender, remove four nuts and washers securing lamp assembly to fender and remove assembly.

b. Installation

1. Position lamp assembly to fender and secure assembly to fender using four nuts and washers.
2. Connect electrical connector to mating connector at tie bar.
3. Connect negative battery cable.

**11. Front Cornering and Side Marker
Light Assembly—693**

a. Removal

1. Disconnect negative battery cable.
2. Disconnect electrical connector to cornering lamp assembly at radiator cradle tie bar.
3. Remove clip, screw and washer securing splash shield to fender and position splash shield out of way.
4. Remove two screws securing lamp assembly to fender and remove assembly from fender.

b. Installation

1. Position cornering and side marker light assembly to fender and install two screws securing assembly to fender.

2. Connect electrical connector to mating connector at tie bar.
3. Reposition splash shield to fender opening and secure to fender using clip, screw and washer.
4. Connect negative battery cable.

**12. Rear Tail, Stop and Signal
Assembly—693**

a. Removal

1. Working inside trunk compartment, remove screws securing side trim panel and position trim panel away from quarter panel.
2. Disconnect bulb and socket assembly.
3. Remove three nuts and sealing washers securing assembly to quarter panel and loosen assembly.
4. Using a sharp knife or similar instrument, cut lamp extension gasket diagonally at bumper upper outboard corner and remove assembly from quarter panel.
5. Remove sealing washers from lamp assembly studs.

b. Disassembly

1. Remove vertical ornament strip from lens.
2. Remove two nuts securing housing to extension and separate housing from extension.
3. Remove two Phillips head screws securing lens assembly to housing and remove lens assembly and gasket from housing.
4. If necessary, upper or lower trim plate can be removed by removing Phillips head screw securing trim plate to extension.
5. Pry vertical ornament strips off of extension, if necessary.
6. Lamp extension to bumper gasket can be removed by removing five screws securing gasket retainer and gasket to extension.

c. Assembly

1. If removed, position upper or lower trim plate to extension and secure with Phillips head screw.
2. Position vertical ornament strips on side of extension and seat strips by tapping lightly with a plastic mallet.
3. Position lamp extension to bumper gasket and retainer, if previously removed, to extension, and secure with five screws.
4. Install gasket on lens assembly and position lens assembly to housing, securing with two Phillips head screws.
5. Position housing assembly to extension, securing housing with two nuts.
6. Install ornament strip on lens.

d. Installation

1. Position lamp assembly to quarter panel. Install a liberal amount of body sealer on washers and then install sealing washers on lamp studs.
2. Secure assembly using three nuts.

3. Install bulb and socket assembly into housing so that locating tang on socket engages notch in housing hole.

4. Reposition side trim panel and install retaining screws.

13. Rear Side Marker Lamp—693

a. Removal

1. Working inside trunk compartment, remove screws securing side trim panel and position panel away from quarter panel.

2. Disconnect bulb and socket assembly by twisting socket from housing.

3. Remove two nuts securing plastic housing to wreath mounting studs and remove housing.

4. Remove wreath from exterior of quarter panel.

5. Remove gasket from housing.

b. Installation

1. Install gasket on housing.

2. Install wreath on exterior of quarter panel

with mounting studs projecting into trunk compartment.

3. Install plastic housing on mounting studs and secure with two nuts.

4. Install bulb and twist socket assembly into housing hole.

5. Reposition side trim panel and install retaining screws.

14. Back-Up Lamp Assembly—693

a. Removal

1. Remove two bolts securing lamp assembly to fuel filler door.

2. Slide assembly down and remove.

3. Disconnect back-up bulb connector and wire retainer.

b. Installation

1. Connect back-up bulb connector and wire retainer.

2. Slide assembly into filler door and secure with two attaching bolts.

BULB DATA CHART

FUNCTION	BULB NO.	C/P	BODY STYLE
Ash Tray Lamp	1445	.7	All
Back-Up Lamp	1156	32	All Except 69347
Back-Up Lamp	1295	50	69347
Clock	1816	3	All
Console Lamp	57	2	69347 (When Ord.)
Cornering Lamp	1295	50	All
Courtesy Lamp - Rear Quarter	90	6	68069-68247-49-68347-49-69-69347
Courtesy Lamp-Console	212/212-1	6	68347-49-67-69347
Courtesy Lamp-Instrument Panel	89	6	All
Courtesy Lamp - Rear Door	212/212-1	6	69723-69733
Courtesy Lamp - Rear Quarter Armrest	212/212-1	6	68367
Cruise Control Speed Selector Illum. Auto. Lock Lamps	1445	.7	All Except 69347 (When Ord.)
Cruise Control Speed Selector Illum. Auto. Lock-Turn on Lamps	1445	.7	69347 (When Ord.)
Engine Temp. Warning Light	161	1	All
Generator Telltale Lamp	161	1	All
Glove Compartment Lamp	1895	2	All
Headlamp - Inner	L4001	37.5 Watts	All
Headlamp - Outer	L4002	37.5W/55.0W	All
Headlamp Switch Lamp	1816	3	All
Heater Control or Climate Control Lamp	1816	3	All
High Beam Indicator	161	1	All
License Lamp	67	4	All
Low Brake Telltale Lamp	161	1	All
Low Oil Pressure Telltale Lamp	168	3	All
Map Lamp	89	6	All

WINDSHIELD WIPER AND WASHER SYSTEM

BULB DATA CHART (CONT'D.)

FUNCTION	BULB NO.	C/P	BODY STYLE
Marker Lamp-Front Side	97A	4	All
Marker Lamp-Rear Side	194	2	69347
Panel Lamp	168	3	All
Park-Signal Lamp	<u>1157 NA</u>	<u>32/3</u>	All
Radio Dial Lamp	1816	3	All (When Ord.)
*Radio AM-FM Band Indicators	250	.5	All (When Ord.)
*Radio AM-FM Stereo Indicators	2812D	.4	All (When Ord.) Except 69723-33-69890
*Radio-Rear Control Indicator	250	1	69723-33 (When Ord.)
Rear Seat Heat Indicator	1895	2	69723-33 (When Ord.)
Spot Lamp-Front Compartment	90	6	69733
Spot Lamp-Reading	1004	15	68169-69723-69733
Stop, Tail and Signal	<u>1157</u>	<u>32/3</u>	All Except 69890
Trunk Compartment Lamp	89	6	All Except 69890
Trunk Lid Tell Tale	161	1	All Except 69890 (When Ord.)
Turn Signal Indicator	168	3	All
Warning Lamp-Front Door (Combined with Courtesy Light)	212/212-1	6	68347-49-67-69-68069-68169- 69347-69723-33
Warning Lamp-Rear Door (Combined with Courtesy Light)	212/212-1	6	68069-68169-68349-68369
Water Temperature Tell Tale	168	3	All

*Serviceable only by Radio Technician.

GENERAL DESCRIPTION

WINDSHIELD WIPER AND WASHER SYSTEM

NOTE: All windshield wiper and washer information with the exception of the removal and installation of the control switch described in Note 68 will be found in this portion of Section 12.

A three speed depressed park wiper and washer system is used on all 1969 Cadillac cars. The wiper system is a tandem, left hand articulated system. The wiper blades move in the same direction at the same time and park to the right. The articulation of the left side is the result of a parallel drag link pinned at the transmission with a swivel mounting at the blade to arm connection. The combination of these features results in increased wiper coverage for maximum forward visibility.

The windshield wiper and washer assembly is mounted on the left side of the cowl. The wiper unit drives a link connected directly to the right hand transmission which is located about five inches off centerline. A second link then goes from the right hand transmission to the left hand transmission. When in the park (off) position, the wiper arms and blades are concealed under the rear of the hood.

The wiper and washer assembly consists of a wiper unit, which contains a 12-volt motor, a gear

box section, a relay control, and a washer unit.

The wiper and washer assembly is controlled by a three-way switch located on the instrument panel extension, which is actually a part of the driver's door, Fig. 12-13. The wipers can be operated at three different speeds as desired. The washers are activated by depressing the washer button, integral with the switch. When the washer button is pushed, the switch lever is moved mechanically to the low speed position. The lever will then stay in the low speed position until the operator moves it to the "OFF" position.

Wiper Electrical Operation

LOW SPEED - Moving the control switch lever to the "Lo" speed position, Fig. 12-14, connects the relay control and shunt field circuit directly to ground. This provides the following circuit:

Current feed to the 25 amp windshield wiper fuse in the fuse panel comes from the accessory terminal on the ignition switch. Current flows through the 18 yellow wire to terminal number 2 of the wiper motor. It then flows through the tan wire to one contact point on the relay switch, and on through the red wire, the relay coil and through the red wire back to terminal No. 1, through the

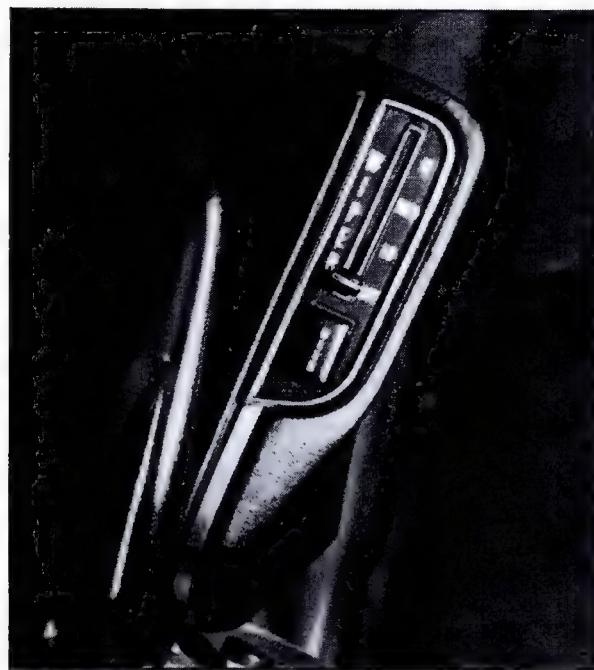


Fig. 12-13 Wiper and Washer Control Switch

light blue wire and the switch to ground. After passing through the relay points, current flows through the black and pink striped wire through the series field and divides; part flowing through the armature and circuit breaker and through the black ground wire, the other part flowing through the shunt field, the solid black wire to terminal number three, and on through the black with orange striped wire to ground at the control switch. Current by-passes the 20 ohm resistor ground circuit at terminal No. 3 at this time, because of the lower resistance of the control switch ground circuit.

MEDIUM SPEED - Moving the control switch to the "Medium" speed position, Fig. 12-14, connects a 13 ohm resistor, located in the control switch, in parallel with the twenty ohm resistor connected from the shunt field circuit. These two resistors, connected in parallel, provide slightly less than eight ohms resistance in the shunt field, allowing less current to flow in the shunt field. This permits correspondingly more current in the armature circuit, resulting in medium speed.

HIGH SPEED - Moving the control switch lever to the "High" speed position, Fig. 12-14, eliminates the path to ground in the control switch, leaving only the 20 ohm resistor in the shunt circuit. This one resistor allows even less current to flow through the shunt field than was possible at either the medium or low speeds, which results in high speed operation.

Wiper Mechanical Operation

In the "Off" position, the wiper gear drive pawl

is located in a slot in the relay and switch assembly, Fig. 12-15. In this position it is pushing against a spring loaded latch arm. The latch arm, in turn, is pushing against a flexible switch contact that holds the switch contacts open. Fig. 12-15 shows the wiper gear mechanism in the "Park" or "Off" position.

When the switch lever is moved to any drive position, the circuit through the relay and switch assembly coil is completed to ground at the dash switch. With the relay magnet coil energized, the latch arm is attracted to the magnet coil. This action trips the latch arm away from the flexible relay switch contact bar, and this allows the switch contact points to close. When the contact points close, the feed to the wiper motor windings is completed and the wiper motor starts.

When the wiper motor first starts, only the gear rotates. The other gear assembly parts (drive pawl, lock pawl, drive plate and shaft, and crank arm) are unlocked from the gear because the drive pawl extends into the relay switch slot.

Since the gear rotates independently during this stage of the "start up", and since the crank arm or output shaft extends through the gear shaft "off center", a cam action results between the output shaft and gear shaft. This cam action causes the drive pawl to move out of the relay switch slot. After the gear has rotated approximately 180 degrees, the spring loaded drive and lock pawl guide pins snap into their respective pockets in the gear, locking the drive or output shafts and related parts to the gear. The complete gear mechanism is now in its normal run position, and the gear, drive pawl, lock pawl, drive plate and shaft assembly and crank arm rotate as a unit.

Moving the switch lever to the "Off" position opens the relay coil circuit to ground at the switch. With the relay coil circuit open, the spring loaded relay latch arm moves out into the path of the gear assembly drive pawl.

The relay switch contact points are still closed at this stage of operation, so the circuit to the wiper motor is still completed. Thus the wiper motor and gear mechanism continues to run. The continuing rotation of the gear assembly causes the drive pawl to engage the latch arm. This action unlocks the drive pawl, lock pawl, drive plate and shaft assembly, and crank arm from the gear, which prevents them from rotating with the gear. However, since the relay switch contact points are still closed, the motor continues to run and the gear continues to rotate. Since the drive shaft extends through the gear shaft "Off center", a cam action results. The resulting cam action causes the drive pawl to move into the relay switch slot. As the drive pawl moves into the switch slot, it pushes against the latch arm which in turn opens the switch contact points. This action opens the circuit to the wiper motor and the wiper motor stops.

WINDSHIELD WIPER AND WASHER SYSTEM

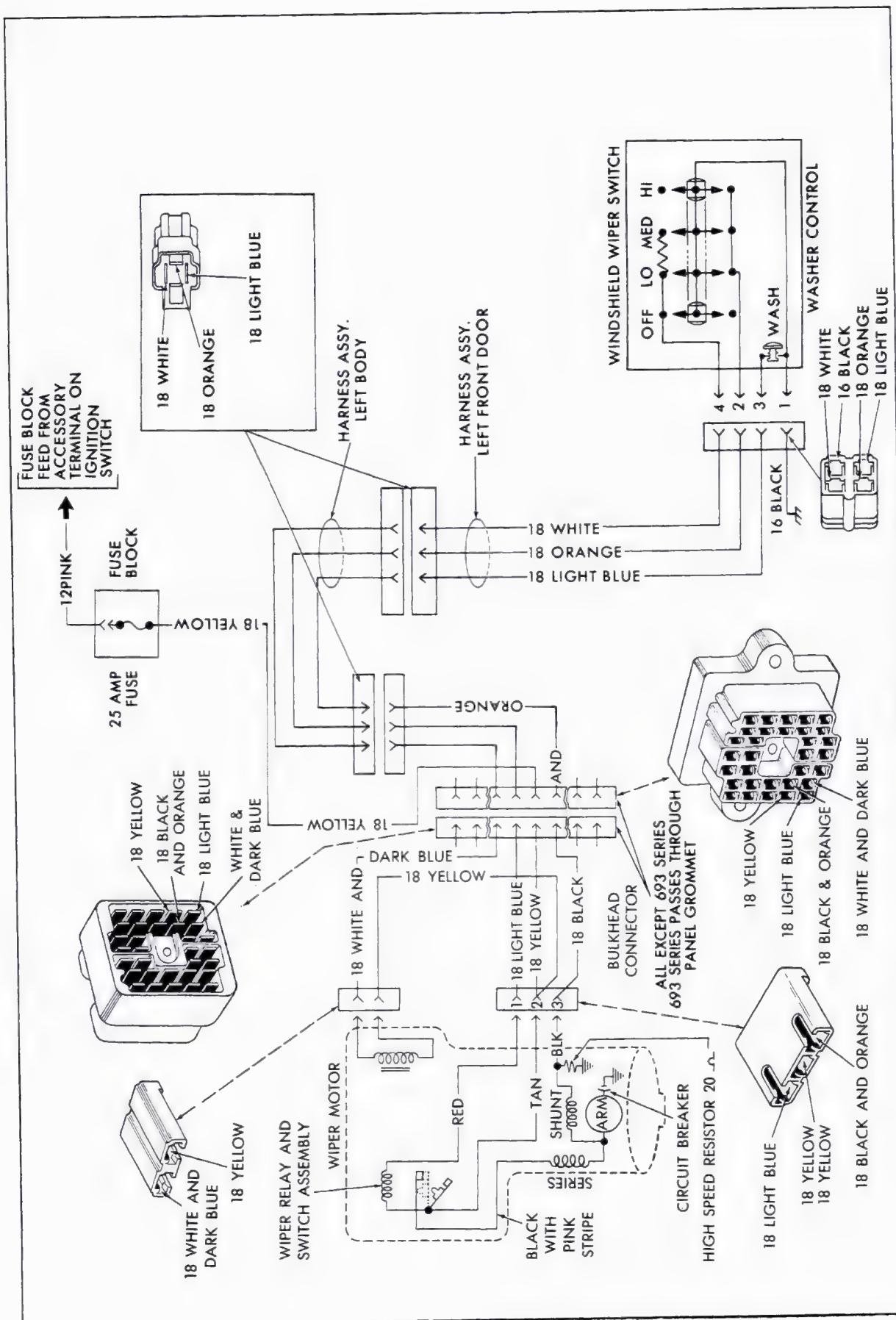


Fig. 12-14 Wiper and Washer Electrical Circuit

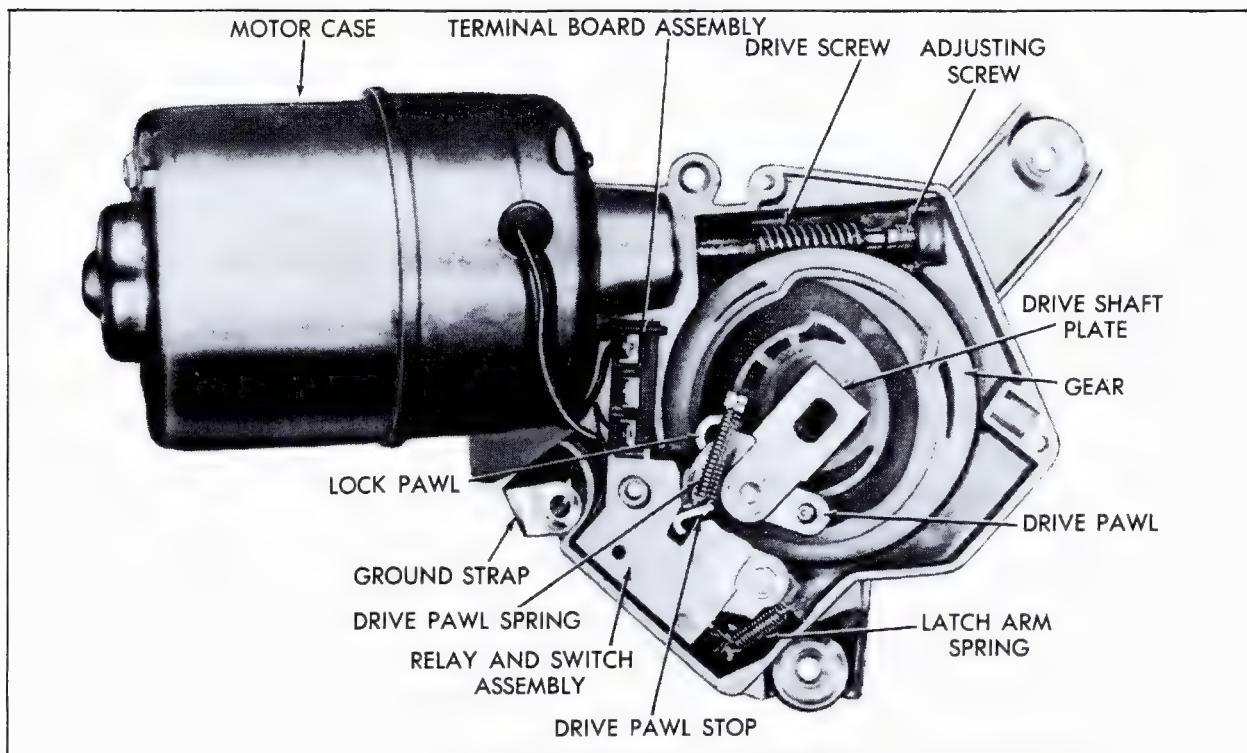


Fig. 12-15 Wiper Drive Mechanism

Washer Circuit

Pushing the washer button on the control switch down mechanically moves the switch lever to the "Lo" speed position. The washer relay coil is energized by the current flowing from the No. 2 terminal on the wiper unit connector through the yellow wire into the relay coil and from there through the white with dark blue striped wire to ground.

Washer Mechanical Operation (Fig. 12-16)

The basic pumping mechanism consists of a spring-loaded piston assembly enclosed in a plastic cylinder. Attached to the piston and extending out of the cylinder housing is an actuator plate.

The elongated slot of the piston actuating plate fits over a pin. This pin is a part of a cam-follower assembly which is actuated by the 4-lobe cam located on the underside of the pump mounting plate. When the wiper is running, the drive gear rotates the 4-lobe cam which in turn causes the cam-follower to move back and forth.

A valve assembly consisting of two exhaust valves and one intake valve is attached to the opposite end of the cylinder housing and controls the flow of washer solution.

When the cam-follower moves away from the pump, the cam-follower pin, which extends through the piston actuating plate, pulls the actuator plate away from the valve assembly, compressing the

piston spring. As the piston moves away from the valve assembly, a vacuum is created in the cylinder which opens the intake valve, drawing washer solution into the cylinder. Then, as the 4-lobe cam continues to rotate, the cam-follower moves in the opposite direction, toward the pump. This permits the piston spring to expand, forcing the piston toward the valve assembly and creating pressure between the piston and valve assembly. This increasing pressure forces the washer solution to open the two exhaust valves, allowing the washer solution to flow to the windshield washer nozzles.

The intake and exhaust stroke cycle will occur four times for each revolution of the wiper drive gear while the washer pump is operating.

The programming section of the pump mechanism consists of the washer relay, ratchet pawl, ratchet wheel and ratchet wheel dog. The ratchet wheel has 11 molded teeth and the tang of the horseshoe spring located inside of the ratchet wheel serves as a tooth, providing the ratchet wheel with a total of 12 teeth.

With the pump at idle, a tang on the piston actuator plate rests against a stop on the lower surface of the ratchet wheel. This, in effect, holds the actuator plate in a "lock-out" position as, with the wiper running, the cam-follower merely moves back and forth in the actuator plate slot and no pumping action can occur.

The ratchet wheel would, if rotated, move the stop away from the actuator plate tang, releasing the pump action. This, however, is prevented from occurring by the construction of the washer

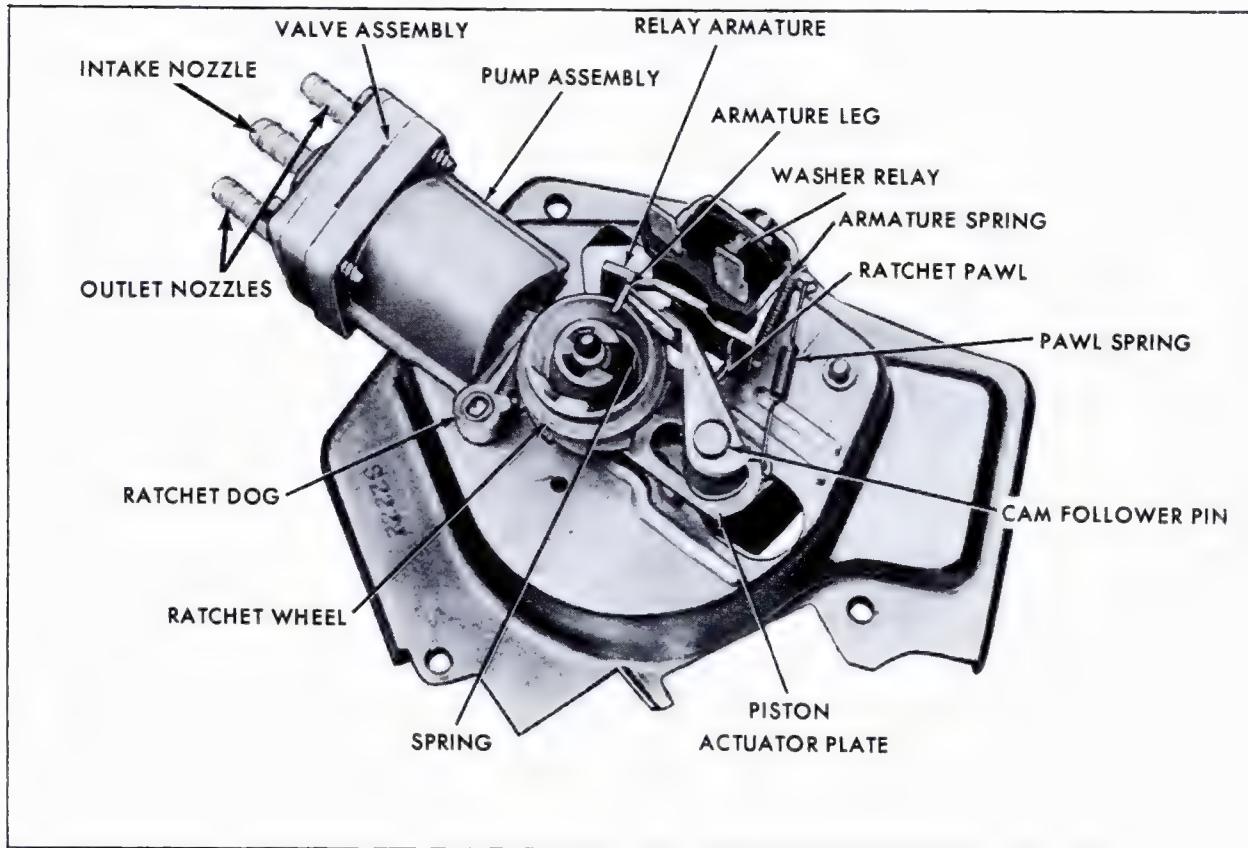


Fig. 12-16 Washer Unit

relay assembly consisting of a coil and armature. When the coil is de-energized, the ratchet wheel pawl extends through an opening in the relay armature, preventing it from engaging the ratchet wheel teeth.

When the washer button is depressed the washer circuit is completed to ground, energizing the washer relay, and places the wiper motor in low speed operation. When the washer relay is energized, the relay armature is pulled toward the coil, allowing the ratchet wheel pawl to drop out of the relay armature opening and engage the teeth of the ratchet wheel.

The ratchet wheel pawl, actuated by the same cam follower pin that moves the piston actuating plate, begins to rotate the ratchet wheel. Rotating the ratchet wheel, one tooth, moves the ratchet wheel stop away from the piston actuating plate tang. This action permits the piston spring to expand, forcing the piston toward the valve assembly resulting in the first exhaust stroke. Then, as the piston actuating plate is pulled back by the cam-follower pin, the piston spring is compressed, causing an intake stroke. This sequence is repeated for the remaining 11 cycles.

The pumping operation is completed automatically when the ratchet wheel has rotated a full 360° and the 12th exhaust-intake cycle has been completed. As the ratchet wheel approaches the completion of its 360° travel, two functions occur

simultaneously. First, the leg on the relay armature rides up a ramp located on the outer surface of the ratchet wheel. When the leg reaches the top of the ramp, it rides over the top of the ratchet wheel, allowing the ratchet wheel pawl to enter the armature opening, thereby, preventing further rotation of the ratchet wheel. At the same time, the stop on the bottom of the ratchet wheel engages the piston actuating plate tang, preventing any further pump action.

15. Windshield Wiper and Washer Unit

a. Removal

1. Disconnect negative battery cable at battery.
2. Disconnect three washer hoses from washer unit control valve. Mark small outlet hoses and corresponding control valve nozzles for identification.
3. Disconnect two-way connector at washer unit and three-way wire connector at wiper unit.
4. Remove cover from opening in left side of cowl to gain access to wiper unit crank arm.

NOTE: Cover is located above wiper and washer assembly.

5. Loosen two locknuts securing wiper unit crank arm to ball socket on end of transmission

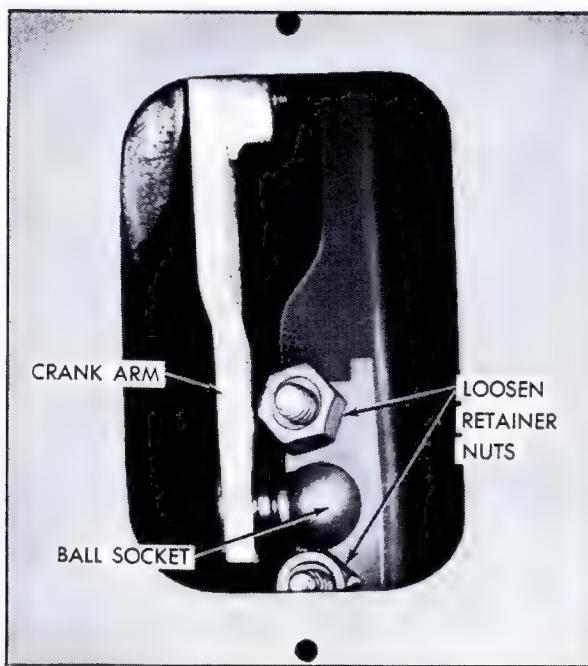


Fig. 12-17 Removing Crank Arm from Ball Socket

drive linkage, then disengage crank arm from ball socket, Fig. 12-17.

CAUTION: Do not remove locknut from ball socket studs.

NOTE: On 693 cars, access to the wiper unit crank arm is gained by removing the air inlet screen.

6. Remove three screws that hold wiper and washer assembly to cowl and remove wiper and washer assembly from cowl.

b. Installation

1. Install wiper and washer assembly on cowl and secure with three attaching screws. Be sure wiper unit crank arm is in PARK position, Fig. 12-18.

2. Working through opening in cowl, install

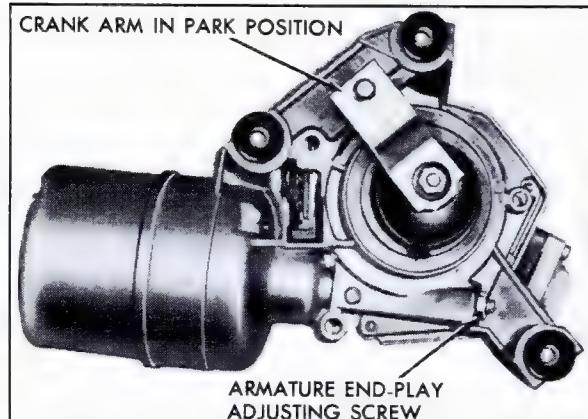


Fig. 12-18 Crank Arm in Park Position

drive linkage ball socket on wiper unit crank arm and tighten two attaching locknuts that hold crank arm to ball socket, Fig. 12-17.

3. Place sealer on reverse side of cover and install cover into opening in left side of cowl.

4. Connect three-way wire connector to wiper unit.

5. Connect two-way wire connector to washer unit.

6. Connect three washer hoses to washer unit control valve as marked during removal.

7. Connect negative battery cable to battery.

8. Check operation of wiper and washer assembly.

16. Windshield Wiper Unit Disassembly and Assembly

NOTE: The following disassembly and assembly procedures for the wiper unit are broken down into two major areas: The motor section and the gear box section. Each section may be serviced independently of the other.

a. Motor Disassembly

1. Scribe a reference line along the side of the casting and motor case to insure proper assembly, Fig. 12-19.

2. Remove the two motor through bolts.

3. Strike motor case lightly with a mallet to loosen it from casting.

4. Feed exposed excess length of motor leads through the casting grommet and carefully back

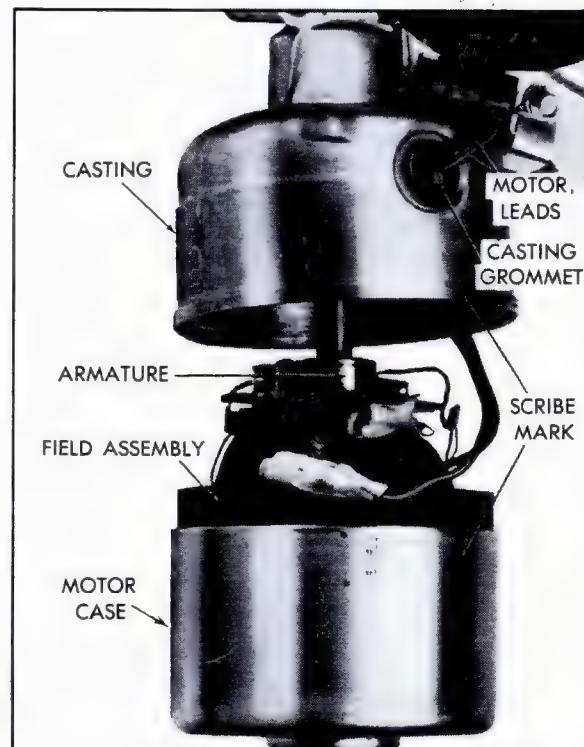


Fig. 12-19 Separating Motor Case from Casting



Fig. 12-20 Detaching Brush Plate

the motor case and field assembly and armature away from the casting, Fig. 12-19.

5. Unsolder the black lead from circuit breaker, Fig. 12-20.

6. Straighten out either set of two brush plate retainer tabs that retain the brush plate to the field coil retainers, Fig. 12-20.

NOTE: The tabs straightened must be on the same side of the brushes.

7. Install Brush Spring Retainer, J-7890, over brush holder that has brush lead attached to circuit breaker, Fig. 12-20.

NOTE: Brush Spring Retainer, J-7890, may be bent slightly on one leg.

8. Holding the brush opposite from that retained in step 7, carefully lift the brush plate off the mounting legs far enough to clear the armature commutator, Fig. 12-21.

9. Allow the brush, held in step 8, to move out of its holder. Remove the brush spring and lift the brush plate off the armature shaft.

10. Lift armature out of case and field assembly.

11. If necessary to replace motor field assembly, cut the solid black and black with pink stripe leads in a location convenient for splicing - preferably near the wiper terminal board.

12. Remove felt washer, steel thrust disc and rubber thrust disc from case assembly bearing as required.

b. Motor Assembly

1. If necessary, splice the leads of the replacement case and field assembly to the corresponding wiper leads cut in step 11 of disassembly pro-



Fig. 12-21 Separating Brush Plate

cEDURE. Solder and tape these joints. Refer to Fig. 12-20.

2. Install the rubber thrust disc, steel thrust disc and felt washer in the case assembly bearing in the order indicated.

3. Be sure steel ball is located in armature end of armature shaft.

NOTE: Replacement armatures are not supplied with thrust ball. To remove thrust ball from original armature, use a magnet.

4. Lubricate ends of armature shaft and thrust ball with high melting point - medium grade lubricant.

5. Assemble armature in the case and field assembly, Fig. 12-22.

6. Position the partially assembled brush plate, Fig. 12-22, over the armature shaft far enough to allow assembly of the remaining brush in its

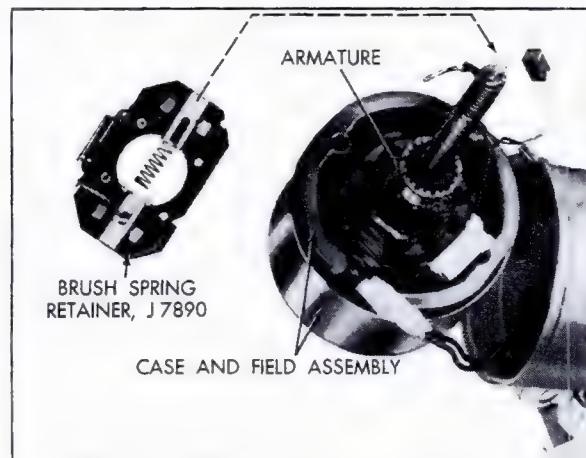


Fig. 12-22 Installing Armature and Brush Plate

brush holder; then position the brush plate assembly on the mounting tabs in the position shown in Fig. 12-20.

NOTE: Circuit breaker ground lead will not reach circuit breaker terminal if brush plate is positioned wrong.

7. Center the brush plate mounting holes over the mounting tabs and bend the two tabs straightened during disassembly toward the brush holders as required to secure the brush plate in position.

8. Remove brush retainer clips and resolder circuit breaker ground lead to circuit breaker, Fig. 12-20.

9. If a new case and field assembly is used, scribe a line on the new case and field assembly in the same approximate position as the one scribed on the original case. This will insure proper alignment of the new case and field with the wiper die case housing.

10. Position armature worm shaft inside the housing and, using the scribed reference marks, line up the case and field assembly with the housing as nearly as possible.

11. Maintaining the armature in its assembled position in the case, start the armature worm shaft through the field and housing bearing until it starts to mesh with the worm gear. At the same time, carefully feed the excess black and black with pink stripe leads through the housing grommet. Be careful not to pinch any motor leads between case and edge of field.

CAUTION: It may be necessary at this point to rotate armature slightly before the worm will engage with worm gear.

12. Rotate the case as required to align the bolt holes in the case with those in the housing.

13. Secure the case to the housing with the two through-bolts.

14. Loosen adjusting screw locknut and adjust screw as required until end of screw just touches end of armature. Then back-off adjusting screw 1/4 turn and tighten locknut.

c. Gear Box Disassembly

1. Remove three screws that hold washer unit to wiper unit and remove washer unit.

2. Remove nut that holds crank arm to drive plate and shaft assembly and remove crank arm.

3. Remove rubber boot seal.

4. Remove snap ring that holds drive gear to drive plate and shaft assembly, using Snap Ring Pliers, J-4880.

5. Remove end-play washers, shield, and spacer washer.

NOTE: The number of end-play washers may vary in different wiper assemblies due to end-play requirements.

6. Slide gear and drive plate and shaft assembly out of housing and remove spacer washer from gear eccentric shaft.

7. Slide drive plate and shaft assembly out of gear assembly and remove drive pawl, lock pawl, and coil spring from drive plate and shaft, Fig. 12-23.

8. Remove screw securing switch and relay assembly to housing and remove switch and relay assembly.

NOTE: If switch and relay assembly is defective, unsolder three leads attached to assembly. Solder leads to new switch and relay assembly.

9. Remove terminal board assembly from housing.

NOTE: If terminal board or 20 ohm resistor is defective, unsolder three leads attached to terminal board assembly. Solder leads to new terminal board assembly.

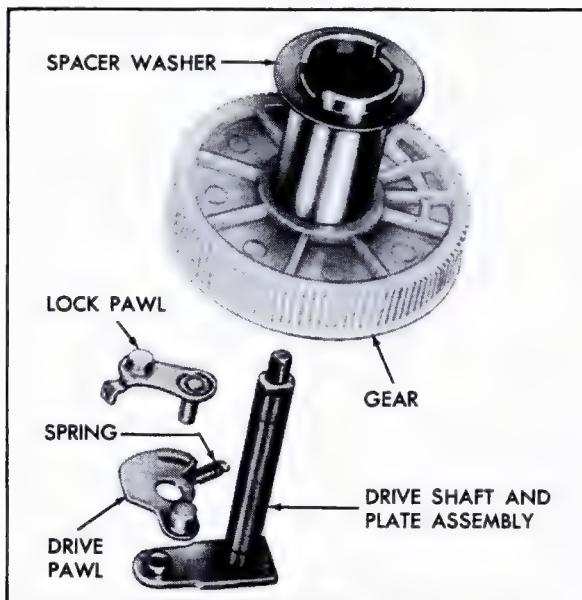


Fig. 12-23 Drive Shaft Assembly - Disassembly



Fig. 12-24 Installing Terminal Board

d. Gear Box Assembly

- Slide terminal board assembly into wiper housing, being careful to position terminal board resistor lead as shown in Fig. 12-24.

NOTE: With the relay and switch assembly replaced in housing and washer pump reinstalled, relay and switch plastic housing applies pressure against resistor lead to form a positive ground connection to wiper housing.

- Install relay and switch assembly into housing and secure with attaching screw.

CAUTION: Be very careful to route leads in such a manner as to avoid having them pinched between relay and wiper housing.

- Assemble drive pawl and lock pawl on drive plate and shaft, Fig. 12-23.

4. Slide gear assembly over drive shaft, Fig. 12-23. Move drive and lock pawls as required to allow their respective pins to fit in the gear guide channel.

5. Holding gear, manually rotate drive shaft plate until drive and lock pawl guide pins snap into their respective pockets in gear.

- Reinstall coil spring between lock and drive pawls.

NOTE: Be very careful to maintain lock and drive pawl guide pins in their respective pockets during step 7.

- Assemble inner spacer washer over gear eccentric shaft and install gear mechanism in housing.

- Install spacer washer, shield, and end-play washers on drive plate and shaft assembly, and

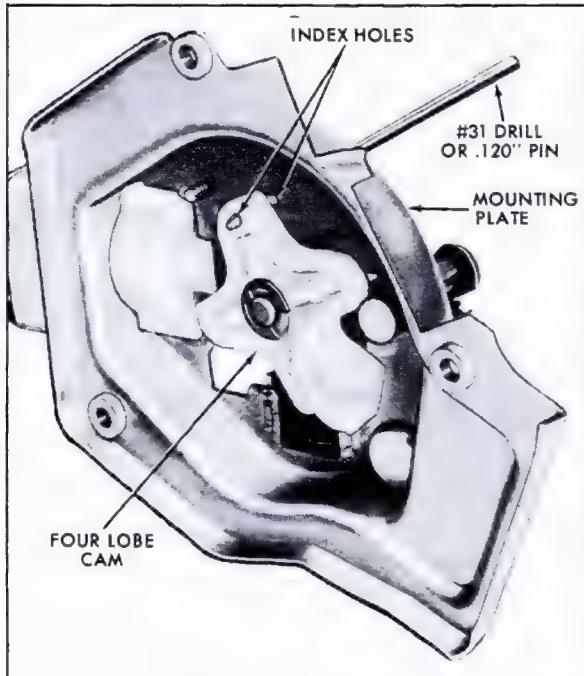


Fig. 12-25 Aligning Washer Cam

secure with snap ring, using Snap Ring Pliers, J-4880.

NOTE: To determine if end-play is correct, place two .005 inch feeler gages, one on each side of the shaft, between snap ring and washers as required to obtain a snug .005 inch clearance.

- Pack rubber boot seal with a high melting point medium grade of lubricant and install seal over shield so that tang on shield is properly fitted to seal.

- Operate wiper unit as described below in steps a through c, to allow wiper unit to return to normal park position before installing crank arm.

- Connect jumper wire from No. 3 terminal to ground.

- Connect 12 volt supply to No. 2 terminal and ground housing. Wiper unit should return to normal park position.

- Disconnect 12 volt supply and jumper wire.

- Install crank arm on drive plate and shaft assembly as shown in Fig. 12-18 and secure with attaching locknut. Tighten locknut to 60 inch pounds.

- Install washer unit to wiper unit as described in Note 17b.

17. Windshield Washer Unit

a. Removal

- Disconnect negative battery cable at battery.
- Disconnect two-way wire connector at washer unit.
- Disconnect three washer hoses from washer unit control valve. Mark small outlet hoses and corresponding control valve nozzles for identification.
- Remove three screws that hold washer unit to wiper unit and remove washer unit from wiper unit.

b. Installation

- Make certain that wiper motor gear mechanism is in Park position, Fig. 12-15.
- Remove retaining ring securing cover to washer unit and remove cover.
- Align index hole in four lobe cam with index hole in cover and insert a .120" (#31) drill, or similar size pin, through mounting plate hole into index hole in four lobe cam, Fig. 12-25.
- Position washer assembly to wiper unit and secure with three screws. Tighten screws to 18 inch pounds.

NOTE: Be sure that ground strap is installed under one of the attaching screws.

- Remove pin or drill used to align four lobe cam.

- If wiper unit is on car, check wiper and washer unit operation.

NOTE: If a knocking noise is heard, four lobe cam has not engaged gear drive pin

properly. It will be necessary to repeat the removal and installation procedures.

7. Install cover on washer unit and install retaining ring securing cover to washer unit.

18. Windshield Washer Unit Disassembly and Assembly

a. Disassembly (Fig. 12-16)

1. Remove washer unit from wiper unit as described in Note 17a.

2. Remove retaining ring securing cover to washer unit and remove cover from washer unit.

3. Remove "E" ring retaining cam to shaft and remove cam from shaft.

4. Disengage pawl spring from pawl and remove spring from coil housing.

5. If present, remove "E" ring retaining pawl to cam-follower post and remove pawl from cam-follower post.

6. Disengage armature spring from coil housing and remove armature spring from armature.

7. Remove armature from coil housing.

8. Remove "E" ring retaining ratchet wheel to shaft.

9. Retract cam follower pin and remove ratchet wheel by lifting straight up.

10. Remove screw securing ratchet dog to mounting plate and remove ratchet dog from mounting plate.

11. Pull pump assembly straight outward to disengage mounting plate from grooves on side of pump, then lift pump upward and remove from cam-follower pin.

12. To remove relay and terminal board assembly from mounting plate, carefully break off the four relay frame staking tabs, using a chisel and hammer.

NOTE: The mounting plate is not serviceable beyond this point.

13. If necessary, remove four screws securing valve assembly to pump after noting position of valve outlets to pump, and remove valve assembly from pump.

NOTE: The pump assembly is not serviceable beyond this point.

b. Assembly (Fig. 12-16)

1. If previously removed, position valve assembly to pump assembly and start two screws in diagonally opposite corners. When alignment is proper, tighten screws securely.

2. Install two remaining screws securing valve assembly to pump assembly.

3. If previously removed, position new relay and terminal board assembly to mounting plate and bend locking tabs over.

4. Position piston actuating plate over cam-follower pin and ratchet wheel shaft with tang on actuating plate pointing up.

5. Holding mounting plate, pull pump assembly

outward until mounting plate can engage grooves on pump assembly and allow pump assembly to slide onto mounting plate.

6. Position ratchet wheel over shaft with stop resting on top of tang on piston actuator plate.

7. Retract cam-follower pin until tang on piston actuator plate clears stop on ratchet wheel, and push ratchet wheel down into place.

8. Install armature on coil housing, with leg of armature resting on top of ratchet wheel.

9. Connect armature spring to armature and to upper tang on coil housing.

10. Install pawl over cam-follower pin, positioning pawl inside of armature opening.

11. Connect pawl spring to pawl and to lower tang on coil housing.

12. Position ratchet dog to mounting plate and ratchet wheel and install retaining screw.

13. Install, if present, "E" ring retainer securing pawl to cam-follower pin.

14. Install "E" ring securing ratchet wheel to shaft.

15. Install cam on shaft and secure with "E" ring retainer.

16. Install washer unit on wiper unit as described in Note 17b.

19. Windshield Wiper and Washer Unit Checking Procedures (On Car)

a. Chassis Wiring

1. Check for blown fuse at fuse panel.

2. Make sure chassis wiring is properly connected to wiper and washer assembly and control switch.

3. Check to see that wiper unit ground strap is properly connected.

4. With ignition switch turned on, check for 12 volts at No. 2 terminal (yellow lead) of wiper unit terminal board, and at No. 4 terminal (yellow lead) that connects to washer unit.

b. Control Switch

1. Check control switch mounting. Loose mounting can cause an intermittent operating condition when using wiper unit.

2. To determine if switch or wiper and washer assembly is defective, try operating wiper and washer assembly independently of switch and chassis wiring as follows:

a. Disconnect multiple connector at wiper unit.

b. Connect 12-volt supply to No. 2 terminal, Fig. 12-26, and connect a jumper wire from No. 1 terminal to ground. Wiper should operate in "Hi" speed.

c. To check "Lo" speed operation, connect a second jumper wire from No. 3 terminal, Fig. 12-26, to ground.

d. To shut wiper unit off, leave jumper from No. 3 terminal connected to ground and disconnect jumper from No. 1 terminal.

NOTE: Wiper unit must always operate in "Lo" speed to park or shut off correctly.

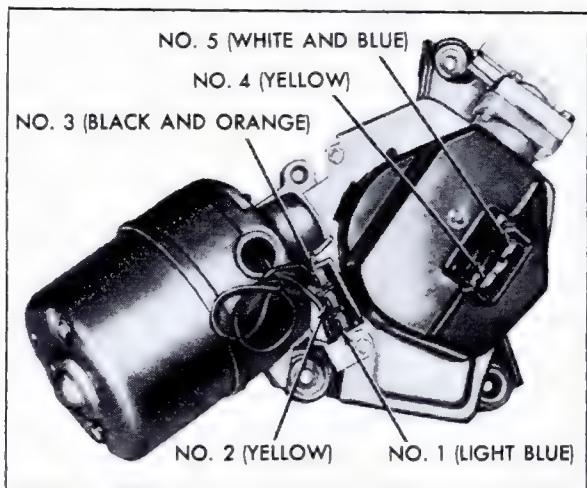


Fig. 12-26 Wiper Unit Terminals

- e. Remove 12-volt supply.
- 3. To determine if washer unit or wiper and washer switch is defective, operate washer pump independently of switch and chassis wiring as follows:
 - a. Disconnect multiple connector at washer unit.
 - b. Operate wiper unit as described above in step 2.
 - c. Connect 12-volt supply to either washer pump terminal and momentarily ground other terminal with jumper wire. This will allow washer unit to operate through one cycle.
 - d. Remove 12-volt supply and connect multiple connectors to wiper unit and washer unit.

c. Wiper Linkage

If the wiper unit seems to be jammed and cannot turn, the trouble may be in the linkage or wiper transmissions. To check the assembly, proceed as follows:

1. Remove screws securing cowl air inlet screen to cowl and remove screen.
2. Remove cover from opening in left side of cowl, on all except 693 Series cars, to gain access to wiper unit crank arm.

NOTE: Cover is located above wiper and washer assembly.

3. Loosen two locknuts securing wiper unit crank arm to ball socket on end of transmission drive linkage, then disengage crank arm from ball socket.

CAUTION: Do not remove locknuts from ball socket studs.

4. Manually operate the linkage and transmission assembly to check for a binding condition in the linkage or a defective transmission. If defective, service as described in Note 22 on all but 693 style or Note 23 on 693 style.

20. Windshield Wiper Unit Checking Procedures (On Bench)

a. Relay and Switch Assembly

1. Remove washer unit from wiper unit to gain access to relay and switch assembly.
2. Check to see that relay latch arm spring and drive pawl spring are properly connected.
3. If gear mechanism is not in full park position, manually operate relay latch arm to check that latch arm moves freely.
4. Connect a 12-volt supply to wiper unit as follows:
 - a. Connect positive lead to No. 2 terminal (tan lead).
 - b. Connect negative lead to wiper unit housing. Do not connect jumper leads to No. 1 and No. 3 terminals.
 - c. Connect one lead of a test lamp to relay switch terminal to which red lead and tan lead are attached, and ground other lead to wiper housing. Failure of test lamp to light indicates defective solder connections in circuit between No. 2 terminal and relay switch terminal, or defective wiring.
 - d. If circuit to relay switch terminal checks out, leave 12-volt supply connected as explained in step 4, and check relay coil as follows:
 - a. Connect one lead of test lamp to No. 1 terminal (red lead), and ground other lead to wiper housing. Failure of test lamp to light indicates an open relay coil or a defective solder connection at No. 1 terminal. Remove test lamp.
 - b. Connect one end of jumper wire to No. 3 terminal (black lead), and ground other end to wiper housing. Manually push in latch arm and observe if it remains in energized position. If so, check for grounded red lead between relay coil and No. 1 terminal. If red lead is not grounded, relay coil is grounded internally. Replace relay and switch assembly.
 - c. Remove jumper wire from No. 3 terminal.
 - d. If motor fails to shut off, disconnect 12-volt supply from wiper unit and check relay switch as follows:

NOTE: If gear mechanism is in full park position, insert a small screwdriver into switch stop slot, and push latch arm down toward relay coil. This will close relay switch points.

 - a. Remove a small amount of insulation from black with pink stripe lead near relay switch. Touch one lead of test lamp to exposed wire, and ground other lead to wiper housing.
 - b. Connect 12-volt supply to wiper unit as explained in step 4. Connect one end of jumper wire to No. 3 terminal (black lead), and ground other end to wiper housing.
 - c. Observe if test lamp goes out once for each revolution of gear or if lamp glows steadily. If lamp glows steadily, relay and switch contacts are not opening. Replace relay and switch assembly.

d. Remove 12-volt supply, and jumper wire from wiper unit housing. Cover exposed wire with tape.

b. Motor Checks

1. For motor checks, disassemble motor as described in Note 16a, steps 1-10 and 24.

2. Check fields for following circuit conditions:

a. Remove a small amount of insulation from black with pink stripe lead and connect a powered test lamp between exposed wire and brush holder to which internal field lead is attached. If test lamp does not light, an open series field is indicated.

b. Connect test lamp between exposed black with pink stripe lead and No. 3 terminal (black lead). If lamp does not light, an open shunt field is indicated.

c. Connect test lamp between exposed black with pink stripe lead and field laminations. If lamp lights, one of the fields is grounded.

3. Remove test lamp, cover exposed wire with tape and reassemble wiper unit as described in Note 16b, steps 2 through 14.

c. Motor Current Draw Test

1. Operate wiper unit in Lo speed as explained in Section "e" of this Note.

2. Connect an ammeter (range 0-30 amps) in series in feed wire circuit to No. 2 terminal, and observe current draw. Allow motor to run until it becomes hot.

a. If current draw is normal (3 to 5.5 amps maximum) and wiper unit cycles on and off, a weak circuit breaker is indicated. Replace brush plate assembly.

b. If current draw exceeds 5.5 amps, perform armature end-play adjustment and gear end-play adjustment as described in Section "d" of this Note. Repeat motor current draw test.

c. If armature end-play adjustment and gear end-play adjustment fail to correct excessive current draw condition, disassemble motor section of wiper unit and check armature on growler for shorted or grounded condition.

d. Wiper Unit Adjustments

1. Armature End-play Adjustment - Loosen adjusting screw locknut and adjust screw as required until end of screw just touches end of armature. Then back-off adjusting screw 1/4 turn and tighten locknut.

2. Gear End-Play Adjustment - Add or remove end-play washers as required to obtain .005 inch minimum end-play.

e. Operating Wiper Unit on Bench

After assembling wiper unit, check motor operation in the following manner. Be sure brass ground strap is connected.

a. "Lo" Speed - Connect positive lead of 12-volt supply to No. 2 terminal (tan lead) and connect negative lead to wiper unit housing. Connect

jumper wires from No. 1 (red lead) and No. 3 (black lead) terminals to wiper unit housing.

b. "Hi" Speed - Remove jumper wire from No. 3 terminal.

c. "Park" or "Shut Off" - Reconnect jumper wire to No. 3 terminal and disconnect jumper wire from No. 1 terminal.

21. Windshield Wiper Arm Replacement

1. Open hood to gain access to wiper arms.

2. Lift wiper arm off windshield and insert a 3/32" drill (#43) in hole behind wiper arm, Fig. 12-27.

3. Release wiper arm, leaving drill in hole, and lift wiper arm assembly off transmission shaft.

4. On left side, slide drag link clip towards end of arm enough to disengage drag link from pivot pin and remove wiper arm and drag link from vehicle.

CAUTION: Do not remove drill installed in Step 2.

5. To install left wiper arm, position drag link on pivot pin and secure by sliding retainer down to pivot pin until it locks.

6. Install wiper arm on transmission shaft.

IMPORTANT: When installing wiper arm and blade assemblies, be sure to "overpark" the arm and blade assemblies below the windshield so that a proper return to park position always results.

7. Pull up on wiper arm and remove 3/32" drill from hole in wiper arm assembly, Fig. 12-27. Release wiper arm and check alignment.

22. Windshield Wiper Transmission (Except 693)

NOTE: Windshield wiper linkage may be checked as outlined in Note 19c.

a. Removal

1. Remove both windshield wiper arms as described in Note 21, steps 1 through 4.

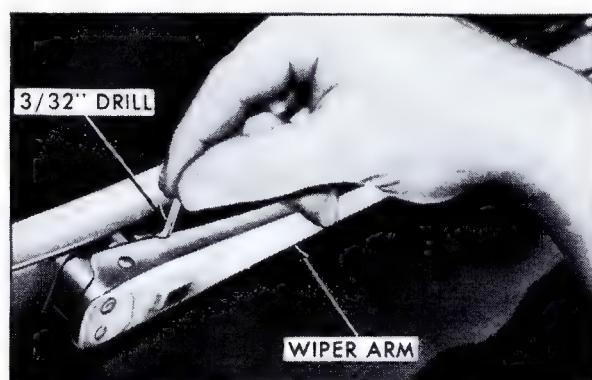


Fig. 12-27 Removing Wiper Arm

2. Remove clips securing rubber hood seal to cowl and position seal out of way.
3. Remove screws securing cowl ventilator screen to cowl and remove screen.
4. Remove two screws from cover on left side of cowl to gain access to wiper unit crank arm and remove cover.

NOTE: Cover is located on top of cowl directly behind the wiper and washer assembly.

5. Loosen two locknuts securing crank arm to ball socket on end of transmission drive linkage, then disconnect crank arm from ball socket, Fig. 12-17.

CAUTION: Do not remove locknuts from ball socket studs.

6. Remove three screws securing left windshield wiper transmission to cowl.
7. Repeat step 6 for right side transmission.
8. Remove linkage by guiding out through right hand transmission opening.

b. Installation

1. Slide linkage into cowl plenum area through opening in cowl.
2. Loosely install three screws securing right wiper transmission to cowl.
3. Repeat step 2 for left wiper transmission.
4. Working through opening in cowl, install drive linkage ball socket on wiper unit crank arm and tighten two lock nuts that hold crank arm to ball socket, Fig. 12-17.
5. Install cover and secure with two attaching screws.
6. Align wiper transmissions and tighten six screws installed in Steps 2 and 3.
7. Install cowl vent screen and secure with attaching screws, being careful to align screen so that all plenum openings are protected.
8. Secure rubber hood seal to cowl with clips.
9. Install both wiper arms as described in Note 21, steps 5 through 7.
10. Check for proper operation of wiper system by operating wiper motor and washer.

23. Windshield Wiper Transmission (693)

a. Removal

1. Remove both windshield wiper arms as de-

scribed in Note 21, steps 1 through 4.

2. Remove screws securing cowl air inlet screen to cowl and remove screen.
3. Remove two screws and access hole cover from opening in center of cowl to gain access to wiper unit crank arm.
4. Remove locknut securing wiper unit crank arm to ball socket stud.
5. Remove three transmission mounting screws on right and left transmissions.
6. Disengage ball socket stud at wiper unit and remove transmissions and linkages as a complete assembly.

b. Inspection and Overhaul

1. Inspect each ball socket for binding, damage or excessive looseness.
2. If either wiper transmission needs to be replaced, use a #10 drill to remove the two rivets holding the defective component to its mating link ball joint.
3. Lubricate link ball carefully.
4. Assemble ball socket bearings around the link ball.
5. Secure socket bearing and link arm with two attaching bolts from parts package. Thin socket bearing should be next to link arm. Install bolts so that screw enters from link arm side.

c. Installation

1. Position transmissions and linkages in shroud top opening with ball socket stud engaging crank arm.

NOTE: When properly positioned, the hole in crank arm will mate with ball socket stud.

2. Install three transmission mounting screws at each transmission, making certain that driver side transmission arm points down and passenger side transmission arm points up.
3. Install locknut securing wiper unit crank arm to ball socket stud, making certain stud is fully seated.
4. Secure access hole cover to cowl with two screws.
5. Position cowl air inlet screen to cowl and secure with retaining screws.
6. Install windshield wiper blades as described in Note 21, steps 5 through 7.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART

CONDITION	CAUSE	REMEDY
Wiper Inoperative.	No power supply at wiper.	Check circuit and chassis wiring as described in Note 19a.
	Defective control switch.	Check control switch mounting as described in Note 19a.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Wiper Inoperative (Cont'd.).	Relay latch arm binding. Defective relay and switch assembly. Defective wiper motor.	Check latch arm as described in Note 20a. Check relay and switch assembly as described in Note 20a. Check motor as described in Note 20b.
Wiper Will Not Shut Off.	Defective control switch or wiring. Relay latch arm binding. Relay switch defective. Relay coil grounded. Relay latch arm spring disconnected or broken.	Check control switch and wiring as described in Note 19a. Free up relay latch arm. Check relay switch as described in Note 20a. Check relay coil as described in Note 20a. Connect or replace spring.
Excessive Speed in "Hi" Speed Range but Operates Normally in "Lo" Speed.	Resistor on wiper terminal board open, or rivets loose. Poor solder connection or defective resistor.	Replace terminal board assembly. Solder connection or replace terminal board assembly.
Blades Do Not Park; Stop at Random.	Defective relay switch.	Replace relay and switch assembly.
Wiper Operates in "Hi" Speed Only.	Defective control switch. Black with orange stripe lead between control switch and wiper unit open. Defective solder connection at No. 3 terminal. Open shunt field.	Check control switch as described in Note 19b. Repair black with orange stripe lead as required. Repair as required. Check motor field assembly for continuity as described in Note 20b.
Wiper Operates in "Lo" Speed Only.	Defective control switch. Black with orange stripe lead between control switch and wiper unit grounded. Shunt field internally grounded. Shunt field black lead to No. 3 terminal grounded. Shorted armature.	Check control switch as described in Note 19b. Check black with orange stripe lead to locate grounded condition and repair. Check field assembly as described in Note 20b. Disassemble wiper as required to locate and repair grounded condition. Check armature as described in Note 20b.
Wiper Transmission Noise.	Excessive end-play in idle shaft and/or reversing link shaft.	Add end-play washers to obtain .005 inch maximum end-play.

WINDSHIELD WIPER AND WASHER DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	REMEDY
Intermittent Operation (wiper alternately stops and starts, at 2 to 3 minute intervals).	Loose control switch mounting. Weak circuit breaker. Shorted condition in wiper motor. Armature end-play adjustment too tight. Gear end-play adjustment too tight.	Tighten control switch mounting. Check circuit breaker as described in Note 20c. Check wiper motor as described in Note 19b and c. Check armature end-play as described in Note 20d. Check gear end-play as described in Note 20d.
Washer Inoperative.	Damaged, kinked, torn or disconnected washer hose, or obstruction in hose. No power supply to washer. Defective control switch. Defective relay coil or poor solder connections. Defective valve assembly. Washer unit mechanism binding.	Repair or replace hose, or remove obstruction. Check circuit from power source to washer. Check control switch as described in Note 19b. Replace relay coil or repair connections. Replace valve assembly. Disassemble washer unit and check for bent or worn parts.
Washer Pumps Continuously When Wiper is "On".	Control switch or wiring is grounded. Relay coil grounded. Washer unit mechanism binding or slipping.	Disconnect wiring from washer pump. If washer stops, check wiring and switch. Repair or replace relay coil. Disassemble washer unit and check for bent or worn parts or stripped tooth or ratchet wheel.
Delay in Water Discharge When Washer Button is Actuated.	Defective washer valve outlet assembly. Pump not holding prime.	Install new valve assembly.
Water Escapes from Washer Nozzles on Sharp Turns.	Defective washer valve outlet assembly.	Install new valve assembly.
Insufficient Water Spray from Washer Nozzle.	Defective washer valve. Loose hose connections. Partially plugged nozzles.	Replace valve. Cut loose end off hose and clean nozzles.

ELECTRICAL INSTRUMENTS

GENERAL DESCRIPTION

The air-core type fuel gage is mounted in a housing at the left side of the speedometer face in the instrument panel cluster. The gage uses balanced needle construction, which means that when the ignition is turned "OFF", the pointer may come to rest at any point.

The instrument cluster has six tell-tale lights, three on each side. Two of these are located in the speedometer dial face: on the left, directly below the left turn signal indicator, is the brake light; on the right directly below the right turn signal indicator, is the engine temperature light. The other four lights are located in the cluster on the same line as the transmission shift quadrant. From left to right these are: trunk generator, oil, and water temperature.

The red brake warning light will light whenever brake pedal travel exceeds a predetermined amount. The red engine temperature light will light whenever the engine metal temperature exceeds 280°F.

The red trunk light will come on whenever the trunk lid is unlocked on cars equipped with Remote Control Trunk Lid. The red oil or generator lights will come on whenever oil pressure is low or the generator is not charging.

The red water temperature light will light when the coolant temperature exceeds 264°F.

The high beam indicator is located just below the sixty mile per hour mark on the speedometer dial face.

The speedometer and odometers are driven by a gear train in the speedometer housing, which is driven through a flexible shaft that is connected to the transmission. The flexible shaft is driven at the transmission by an output gear designed especially for the vehicle, and takes into consideration such variables as tire size and differential ratio.

The odometer portion, which indicates distance traveled, is divided into two sections -- the left half (season odometer) records accumulated mileage and the right half indicates trip mileage. A reset knob for the trip odometer is located in the instrument cluster. Push in fully and turn to reset. No attempt should be made to reset the season odometer. An anti-reverse pawl prevents driving the odometer in a reverse direction.

The turn signal indicators are located in the speedometer dial face and light up as green arrows when the turn signals or hazard warning flasher are used.

Twin "F" and "A" seashell horns, matched in tone, are located in the box section directly behind the left headlamp on all models. In addition to these horns, all deVille models have a low "D" horn mounted on the radiator cradle tie bar. A high "C" trumpet horn is available as optional equipment on all models. The horn relay is

mounted inside the car on the dash insulator to the upper left of the brake pedal.

The clock is located in the instrument panel to the right of the cluster. It has a spring driven movement which is electrically wound. The clock winds every one or two minutes, but draws current for only a fraction of a second each time it winds. It can be reset by pushing in and turning the reset knob. Automatic regulation occurs when the knob is moved.

The engine metal temperature switch, located on the rear of the left cylinder head, (front of right cylinder head on Eldorado) senses the metal temperature of the engine. When the engine temperature exceeds 280°F, the switch closes completing the circuit to ground, causing the Eng. Temp. tell-tale light to light and the horn relay buzzer to sound. The light will also light and buzzer sound when the driver's door is opened with the key in the ignition lock in the "OFF" position.

The electrical instruments portion of this section covers disassembly, assembly and testing procedures of serviceable instrument panel components. Procedures for removal and installation of electrical instruments that may be considered a part of, or attached to, the instrument panel are in the Instrument Panel portion of this section.

Engine Metal Temperature System Circuitry (Fig. 12-28)

When the engine metal temperature exceeds 280°F, the engine temperature sending unit switch closes. Current from the horn circuit breaker flows through the 14 red wire, through the horn relay and warning buzzer coil, through the normally closed (N.C.) contact points, through the 18 white wire to the cluster connector, and then through the 18 violet with white stripe wire to the bulkhead connector. The current then flows through the bulkhead connector, through the 18 dark green with white stripe wire to the engine temperature sending unit switch and then through the switch to ground.

When the engine metal temperature switch is closed, the ground is completed for the engine metal temperature tell-tale light that draws its feed from the body fuse through the 18 orange wire. Current flows through the engine metal temperature tell-tale light, illuminating the light, through the 18 violet with white stripe wire to the bulkhead connector, through the bulkhead connector, through the 18 dark green with white stripe wire to ground at the switch.

When the relay coil is energized, the normally closed contacts open, breaking the circuit and de-energizing the coil. This, in turn, allows the

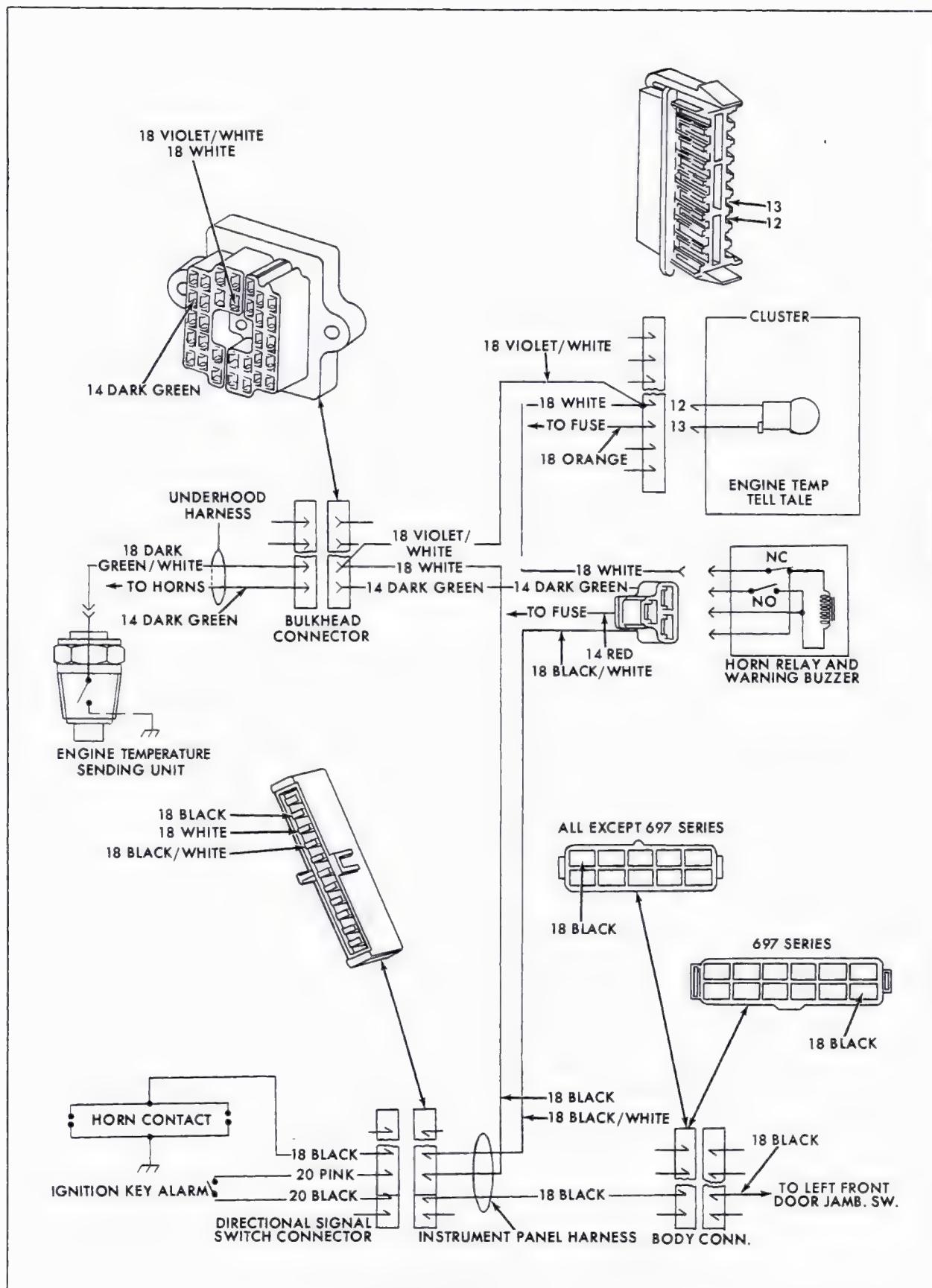


Fig. 12-28 Engine Temperature Warning System

normally closed contacts to close again, completing the circuit and energizing the coil again. As the normally closed contacts open and close in rapid succession, the buzzer sound is produced.

24. Fuel Gage Service

When checking the fuel gage circuit, first determine whether the tank unit, wiring, or fuel gage is faulty. Perform the following tests to find the trouble.

a. Ignition On—Gage Does Not Register

1. Turn the ignition switch on. Fuel gage should register. If it does not proceed to step 2 and continue until defective component is isolated.

2. If fuel gage, oil pressure light and generator tell-tale fail to register, the fault may be an open in the 18 pink wire to the printed circuit, part b of Note 33.

3. Check fuel gage dash unit as described in part e of this note.

4. Check for an open printed circuit (#9 circuit), part e of Note 33.

b. Ignition On—Gage Registers Full Under All Conditions

1. Turn ignition switch on. If gage registers full under all conditions, proceed to step 2 and continue until defective component is isolated.

2. Check for a defective tank unit or poor ground as described in part d of this note.

3. Check for open 18 tan wire from printed circuit to tank unit as described in part c of Note 33.

4. Check for an open printed circuit (#2 circuit), part e, Note 33.

c. Ignition On—Gage Registers Empty Under All Conditions

1. Turn ignition switch on. If gage registers empty under all conditions, proceed to step 2 and continue until defective component is isolated.

2. Check for a grounded tank unit rheostat as described in part d of this note.

3. Check for a defective or poorly grounded dash unit as described in part e of this note.

4. Check for a short to ground in the 18 tan wire from the printed circuit to the tank unit as described in part d of Note 33.

5. Check for a short to ground in the printed circuit (#2 circuit) as described in Note 33, part e.

d. Checking Fuel Gage Tank Unit

CAUTION: Make certain the headlight switch is off when performing this test as accidentally grounding the lamp circuit wire inside the connector with a jumper lead may open the headlight switch circuit breaker.

NOTE: Make certain 18-way connector at

instrument panel is connected, if previously disconnected.

1. Disconnect printed circuit to tank unit tan wire at connector inside license plate mounting door. On 693 styles, disconnect tan wire just inside trunk compartment.

2. Turn ignition switch on.

3. With wire disconnected, the dash unit pointer should read above the "full" mark. Then connect a jumper to the connector and ground the printed circuit to tank unit wire. The dash unit should read below the "empty" mark.

4. If system performs properly during this test and fuel gage fails to register when connected, the tank unit is defective.

5. If tank unit is found to be defective by this test, first check for a good ground. Make sure that mounting screws are tight, or on 693 style, that ground wire is securely welded to tank unit cam lock. Ground lead from tank unit should also be in good condition. Check to see that ground wire is securely attached to frame at the rear of tank for standard series, and securely attached to body structure in front of the tank on 693 style. If either tank unit is burned out, or tank unit rheostat is grounded, replace tank unit.

e. Fuel Gage Dash Unit Check

1. Remove upper instrument panel cover as described in Note 44a.

2. Disconnect multiple connector at instrument panel cluster case.

3. Remove protective cover from fuel gage, using care not to damage printed circuit.

4. Using an 18 gage jumper wire, connect one end to battery terminal of starter motor solenoid and other to cluster gage unit stud that is farthest from cluster face. Fuel gage should read full.

CAUTION: Make sure that multiple connector is not connected. Under no circumstance should a hot lead be connected to terminal on dash unit that leads to tank unit with multiple connector attached. If the tank unit is connected to battery in any manner, tank unit will be burned out because resistance of the dash unit is by-passed.

5. Using a second jumper wire, ground stud closest to cluster face on fuel gage. Gage should now read empty. If gage does not perform as described in steps 4 and 5, it should be replaced.

f. Bent Float Arm Check

If the above checks indicate the float unit is at fault, the float arm should be checked for a bent condition before replacing either unit. Check as follows:

1. Establish a fixed reference point when checking for a bent float arm by placing a straight edge as illustrated on surface of cover plate, extending it outward. See Fig. 12-29 for all but 693 style or Fig. 12-30 for 693 style.

2. On all but 693 style, with float arm in

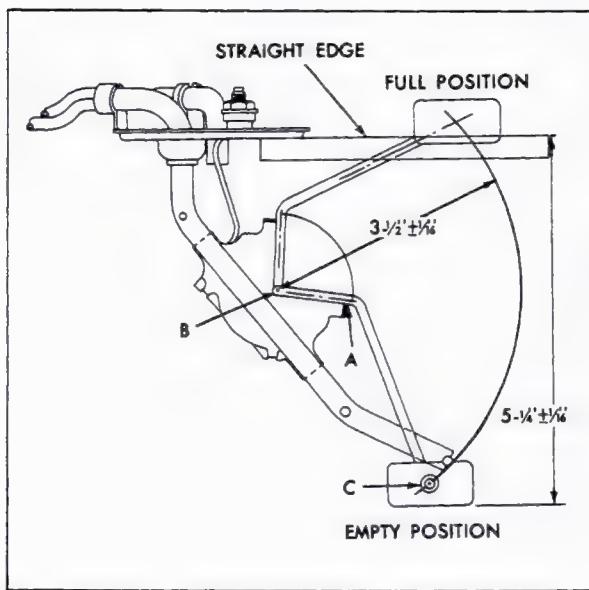


Fig. 12-29 Checking for Bent Float Arm (Exc. 693)

"Empty" position against stop "A", distance from bottom of float (with float horizontal) to straight edge should be $5\frac{1}{4}'' \pm \frac{1}{16}$ inch, Fig. 12-29. Bend float arm as needed. Check distance from point "B" to "C" which should be $3\frac{1}{2}'' \pm \frac{1}{16}$ inch, Fig. 12-29. Bend float arm as needed and recheck distance from bottom of float to straight edge.

3. On 693 style, with float arm in "Empty" position against stop "A", distance from bottom of float to straight edge should be $6\frac{19}{32}'' \pm \frac{1}{16}$ inch, Fig. 12-30. Bend float arm as needed. Check distance from point "B" to "C" which should be $4\frac{5}{16}'' \pm \frac{1}{16}$ inch, Fig. 12-30. Bend float arm as needed and recheck distance from bottom of float to straight edge.

4. Check for a binding condition of float arm. On all but 693 style, make certain that float arm is not touching filter.

25. Fuel Gage Tank Unit (All Except 693)

a. Removal

1. Remove fuel tank as described in Section 8, Note 2a.
2. Remove locknut securing fuel gage tank unit wire to tank unit and remove wire from tank unit.
3. Remove five screws and six washers securing gage tank unit to tank and lift unit out of tank. Discard gasket.
4. Remove fuel strainer from gage tank unit and replace if necessary.

b. Installation

1. Install fuel strainer on gage tank unit.
2. Install gage tank unit in fuel tank using new gasket, and install four mounting screws and

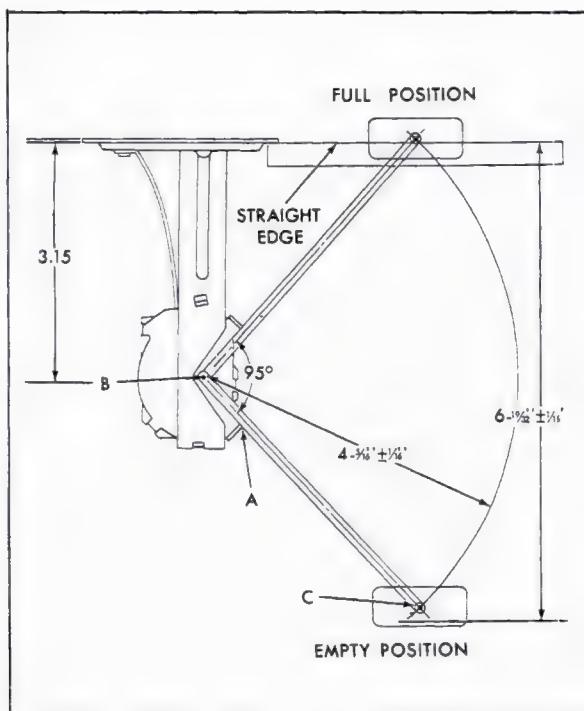


Fig. 12-30 Checking for Bent Float Arm (693)

washers at all holes except ground. At ground screw hole, position washer, ground wire and second washer, securing with screw.

3. Connect fuel gage wire to gage tank unit and secure with attaching locknut.

4. Install fuel tank as described in Section 8, Note 2b.

26. Fuel Tank Float Unit (693)

a. Removal

1. Open deck lid and remove rear carpet trim to gain access to float tank unit.
2. Cut out mat over tank float unit.
3. Clean excess sealer from edges of cover plate and pry cover plate up to remove.
4. Remove nut, starwasher, brown wire and insulating washer from tank unit.
5. Using Float Tank Unit Wrench, J-21518-01, remove cam lock as shown in Fig. 12-31.
6. Remove tank float unit from tank being careful not to damage ground wire.
7. Cover fuel tank unit opening and working away from tank, unsolder black float tank unit ground wire.

b. Installation

1. Solder black ground wire to float tank unit working away from tank.
2. Uncover fuel tank unit opening and install tank float unit in tank.
3. Using Float Tank Unit Wrench, J-21518-01 install cam lock as shown in Fig. 12-31. Be sure

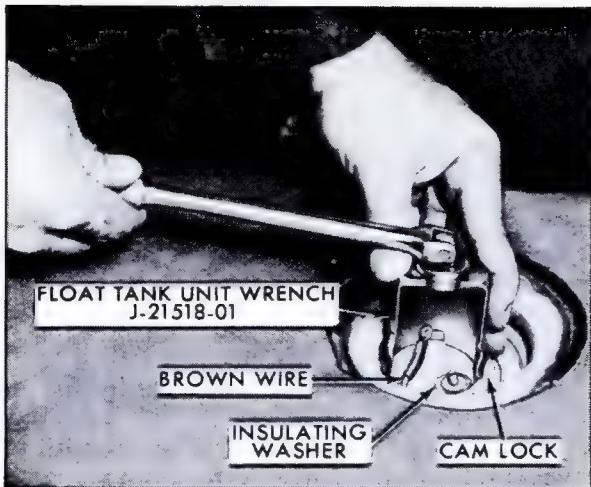


Fig. 12-31 Removing Float Tank Unit (693)

cam is rotated completely and is in retaining detents.

4. Install insulating washer, brown wire, star-washer and secure with nut.

5. Place sealer on cover plate and position on fuel tank float unit.

6. Install portion of mat cut out during disassembly.

7. Install rear carpet trim and close deck lid.

27. High Beam Indicator Circuit

When checking high beam indicator circuit, determine whether bulb, wiring or dimmer switch is defective. Perform the following tests as indicated to find the trouble.

1. Turn headlights on and on cars equipped with Guide-Matic, rotate sensitivity and master on-off control lever fully counterclockwise to OFF. If high beam indicator light does not glow, depress foot switch. If high beam indicator light still does not glow, proceed to step 2 and continue until defective component is isolated.

2. Check for a burned out indicator bulb as described in part a of Note 33.

3. Check instrument panel feed circuit (18 light green wire) as described in part b of Note 33.

NOTE: The following step (4) should be followed for cars not equipped with Guide-Matic. For Guide-Matic equipped cars, proceed to step 5.

4. If step 3 does not check satisfactorily, remove foot switch connector and touch one lead of a test lamp that is not self powered to 16 light blue wire and ground other lead. Lamp should light. If it does not light, proceed to step 5. If it does light, dimmer switch or light green wire to printed circuit is defective. Replace dimmer switch on a trial basis. If the problem is not in dimmer switch, the 16 light green wire is open.

5. If step 3 does not check satisfactorily, disconnect 3-way connector (yellow, light blue and violet wires) at Guide-Matic power relay. High beam indicator should glow. If it does not, replace power relay.

If light glows with connector disconnected but does not glow with connector connected, disconnect 3-way connector at foot switch. If light glows, replace foot switch.

If the above procedures fail to cause high beam indicator to glow, remove 4 amp fuse in Guide-Matic harness. If indicator still does not glow, check four-way connector at Guide-Matic amplifier. If connector is good, replace amplifier.

6. Using a test lamp that is not self powered, probe 16 light blue wire at headlight switch, and ground other lead. Lamp should light. If it does, open is in 16 light blue wire between headlight switch and dimmer switch.

7. Probe 14 yellow wire at headlight switch with one test lamp lead of a test lamp (not self powered) and ground other lead. Lamp should light. If it does light, headlight switch should be replaced. If lamp does not light, trouble is in wiring from headlight switch to positive battery terminal. Begin at No. 1 terminal connection of headlight switch and check continuity of circuit.

28. Trunk Lid Circuit

When checking trunk lid circuit, determine whether trunk lid switch, bulb, wiring or printed circuit is defective. Perform the following test to isolate the condition.

a. Trunk Lid Open

1. With trunk lid open and ignition switch in the "ON" position, trunk lid bulb in instrument panel should glow. If it does not, proceed to step 2 and continue until defective component is isolated.

2. Disconnect wire connector at trunk lid and use a paper clip to ground the wire connector. If bulb lights, but did not light in step 1, the switch must be replaced.

3. Check for a burned out indicator bulb as described in part a of Note 33.

4. Check 18 pink wire to the printed circuit as described in part b of Note 33. An open in this wire will also cause the fuel gage and the generator tell-tale to be inoperative.

NOTE: This wire also feeds water temperature indicator light and the low brake light.

5. Check 18 dark green wire for an open as described in part c of Note 33.

6. Check 18 dark green wire for a short as described in part d of Note 33.

7. Check printed circuit (Circuit #7 and #9) for an open as described in part e of Note 33.

29. Low Brake Indicator Switch

The low brake indicator switch is in line with the brake line and cannot be adjusted. If the switch is defective, it must be replaced.

If an inoperative low brake indicator circuit is suspected, the bulb and wiring may be checked as outlined in Note 33, parts a through e.

30. Oil Pressure Indicator Service

The oil pressure indicator light is connected in a circuit with the ignition switch and a pressure operated switch threaded into the oil header galley at rear of engine. Indicator light warns driver when oil pressure is below 4 pounds \pm 1-1/2 pounds.

If light does not come on when the ignition switch is turned on, or if light stays on after engine is started and run for 30 seconds, either pressure is low or one of the following units is defective: wiring, bulb, printed circuit, or oil pressure switch. Check as outlined below.

a. Ignition On—Engine Not Running

1. Turn ignition switch on but do not start engine. Oil indicator light should glow. If it does not, proceed to step 2 and continue until defective component is isolated.
2. If oil pressure light, fuel gage, generator tell-tale and temperature tell-tale fail to register, fault is probably an open in 18 pink wire to printed circuit, part b of Note 33.
3. Check operation of oil sender switch as described in part c of this note.
4. Check condition of tell-tale bulb as described in part a of Note 33.
5. Check condition of 18 dark blue wire from printed circuit to oil pressure switch as described in part c of Note 33.
6. Check condition of printed circuit as described in part e of Note 33.

b. Engine Running

1. Start engine and run for 30 seconds. Oil pressure indicator light should not glow. If it does, proceed to step 2 and continue until defective component is isolated.
2. Check operation of oil sender switch as described in part c of this note.
3. Check 18 dark blue wire for a short to ground as described in Note 33, part d. Repair or replace as necessary.
4. Check for a defective printed circuit (#10 circuit) as described in Note 33, part e.

c. Oil Pressure Switch Check

1. Disconnect dark blue wire at oil pressure switch.
2. Turn ignition switch to ON position but do not start engine.
3. Connect a test lamp consisting of a one-candle power bulb and pair of test leads in circuit by clipping one lead to battery terminal of starter solenoid and other lead to terminal of oil sender switch. Test bulb should light; if it does not, oil pressure switch is open and should be replaced.

NOTE: Sealing compound on threads of switch may cause this condition and should never be used.

4. Start engine and run for 30 seconds. Test lamp should not light. If it does, the oil pressure switch is shorted or the oil pressure is low. Replace switch on a trial basis. If new switch does not correct condition, remove switch and test pressure with a reliable pressure gage. Repair as necessary.

31. Water Temperature Indicator Service

When checking the water temperature tell-tale circuit, determine whether engine thermogage unit, wiring, dash unit or printed circuit is faulty. Perform the following tests to isolate the trouble.

a. Ignition in "Crank"—Bulb Does Not Light

1. Turn ignition to "crank" position. Tell-tale bulb should come on during cranking and go out when engine starts. If bulb fails to light, proceed to step 2 and continue until defective component is isolated.
2. Check condition of tell-tale bulb as described in part a of Note 33.
3. Check for an open 18 orange wire to the printed circuit, part b of Note 33.
4. Check thermogage unit as described in part d of this note.
5. Check for an open in the printed circuit (#14 circuit) as described in part e of Note 33.

b. Ignition On—Tell-Tale Registers Hot Under All Conditions

1. Turn ignition switch on. If tell-tale comes on under all conditions, proceed to step 2 and continue until defective component is isolated.
2. Check thermogage unit as described in part b of this note.
3. Check for shorted condition in 18 dark green wire as described in part d of Note 33. Locate short and repair.
4. Check for a shorted printed circuit (#14 circuit) as described in part e of Note 33.

c. Engine Thermogage Unit Check

1. Disconnect dark green wire at thermogage unit.

2. Connect a test lamp consisting of a three-candle power bulb and a pair of test leads in circuit by clipping one lead to terminal of thermogage unit. Test bulb should not light. If it does light when connected in this manner, thermogage unit is shorted and should be replaced.

3. Remove test lead from gage terminal and touch it to body of unit. Bulb will light if unit is grounded properly. If it does not light, check for presence of sealing compound around threads of unit. Remove compound and repeat test.

NOTE: Never use any sealing compound on thermogage unit to stop water leaks. If tightening unit does not stop leakage, it should be replaced.

4. Remove test lamp and install dash gage wire on thermogage unit if it tests satisfactorily.

32. Engine Metal Temperature Indicator Service

1. With ignition switch "ON", disconnect electric connector at engine temperature switch and ground dark green white striped wire. Engine temperature tell-tale light should light and buzzer relay should sound.

2. If system fails completely to perform as outlined in step 1, proceed as follows:

a. Check for open in 18 violet with white stripe wire.

b. If buzzer did not sound, ground terminal #4 at horn and buzzer relay to determine if failure is in relay or in #18 white wire.

c. If engine temperature tell-tale light failed to light, check printed circuit as described in Note 33.

33. Checking Circuits Using Printed Circuit

If any of the following circuits do not operate properly, check the corresponding notes to isolate the problem: fuel gage circuit, Note 24; high beam indicator circuit, Note 27; trunk lid circuit, Note 28; oil pressure tell-tale circuit, Note 30; charging circuit; Section 6, Note 32; temperature circuit, Note 31; "Eng. Temp." tell-tale, Note 32.

If performing checks on the illumination circuit, proceed directly to this note.

a. Checking For Burned Out Tell-Tale Bulb

1. On all circuits using tell-tale bulbs, remove upper instrument panel cover as described in Note 44a.

2. Remove wedge base socket bulb for affected circuit, Fig. 12-32, and replace if necessary.

3. If bulb is all right, install and proceed to part b of this note.

b. Checking Instrument Panel Feed Circuits For Open

1. Remove upper instrument panel cover as described in Note 44a, if not done previously. Leave battery cable attached.

2. Disconnect 18-way connector at back of instrument panel cluster case.

3. Use the following table to identify the circuit wiring color code and perform preliminary steps needed to check the continuity.

4. To check any circuit, touch one lead of a test lamp that is not self-powered to feed circuit terminal at wiring harness connector of affected circuit and ground other lead. Test lamp should light. If it does not light, trace the circuitry to the harness connector using chassis circuit diagram at back of this section. If test lamp lights, proceed to part c of this note.

Hot Circuit	Wire Color Code	Preliminary Steps
High Beam Indicator	18 Light Green	Headlamp switch all the way out. Dimmer switch on Hi-Beam.
Illumination	18 Gray	Headlamp switch halfway or fully out.
"Eng. Temp"	18 Dark Blue (RH) 18 Light Blue with Blue Stripe (LH)	Ignition switch on and signal lever actuated.
Ignition, which feeds all other instrument panel circuits other than those above.	18 Pink	Ignition switch is in on position.

**c. Checking Sender Circuits or
Switch Side of Circuit For Open**

1. Remove upper instrument panel cover as described in Note 44a, if not done previously.
2. Disconnect 18-way connector at back of

instrument panel cluster case, if not done previously.

3. Use the following table to identify the circuit wiring color code and perform the necessary preliminary steps needed to check the continuity of the circuit.

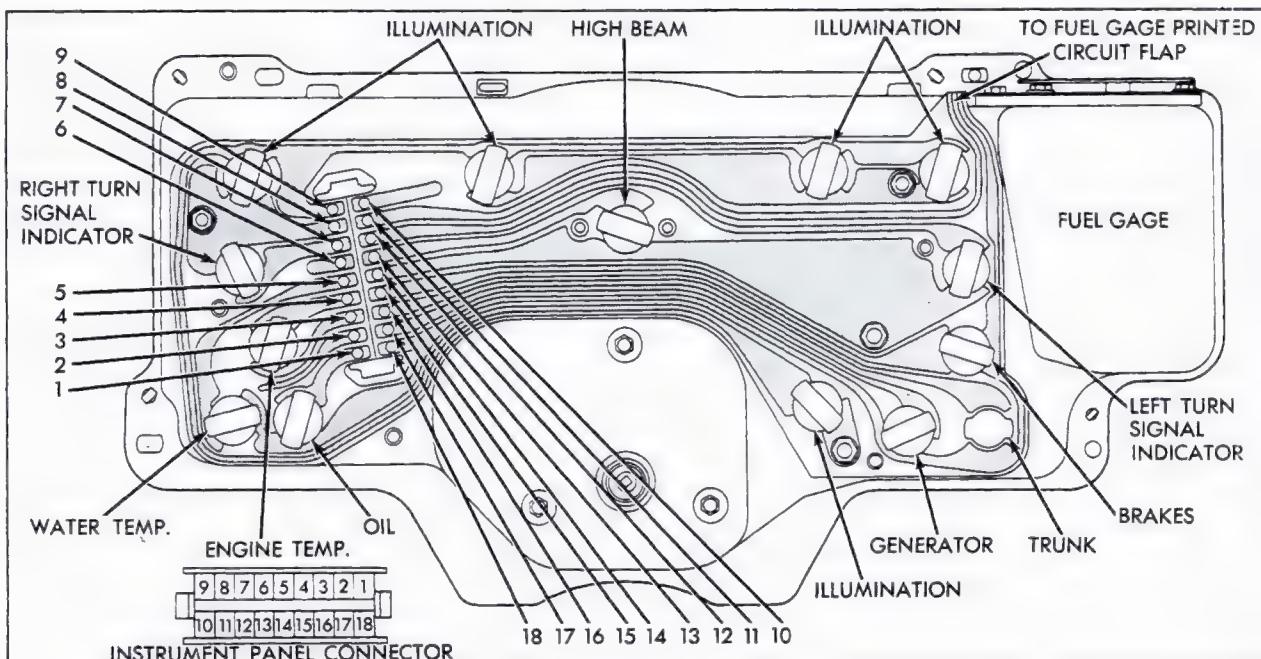


Fig. 12-32 Printed Circuit

INSTRUMENT CLUSTER PRINTED CIRCUIT LEGEND

No. and Circuit	Wiring Color Code	No. and Circuit	Wiring Color Code
1. Not Used		10. Oil Pressure Tell-Tale (Sender Side)	18 Dark Blue
2. Fuel Gage (Sender Side)	18 Tan	11. Not Used	
3. L.H. Signal Indicator	18 Light Blue with Blue	12. Engine Temp Tell-Tale (Switch Side)	18 Violet with White
4. Hi-Beam Indicator	18 Light Green	13. Engine Temp Tell-Tale (Feed Side)	18 Orange
5. Illumination and L.H. Signal Indicator (Ground Side)	18 Blue	14. Water Temp Tell-Tale (Switch Side)	18 Dark Green
6. Low Brake (Switch Side)	18 Tan	15. Not Used	
7. Trunk Lid (Switch Side)	18 Dark Green	16. R.H. Signal Indicator (Switch Side)	18 Dark Blue
8. Generator Tell-Tale (Sender Side)	16 Brown	17. Illumination and R.H. Signal Indicator (Ground Side)	18 Blue
9. Ignition - Feeds Fuel Gage, Low Brake Tell-Tale, Trunk Tell-Tale, Generator Tell-Tale, Oil Pressure Tell-Tale, and Water Temp Tell-Tale	18 Pink	18. Illumination (Feed Side)	18 Gray

Sender or Switch Circuit	Wire Color Code	Preliminary Steps
Fuel Gage (Sender Side)	18 Tan	Disconnect and ground brown wire at connector inside license plate mounting door. On 693 styles ground tan feed wire at connector just inside trunk.
High Beam Indicator	18 Light Green	Disconnect and ground light green lead at dimmer switch connector.
Trunk Lid (Switch Side)	18 Dark Green	Deck lid open. Ignition on.
Low Brake (Switch Side)	18 Tan	Disconnect 18 Tan wire at low brake indicator switch. Ground 18 Tan wire with jumper wire.
Oil Pressure Tell-Tale	18 Dark Blue	
Temperature Tell-Tale	18 Dark Green	
"Eng. Temp." Tell-Tale	18 Violet with White	Disconnect 18 Dark Green with White wire at cylinder head sending unit and ground wire.

4. To check the circuit, touch one lead of a test lamp that is self-powered to terminal at wiring harness connector of affected circuit and ground other lead. Test lamp should light. If it does not light, trace circuitry wiring and affected sender or switch by using chassis circuit diagram at back of this section. If it does light, proceed to part d of this note.

d. Checking Sender Circuits or Switch Side of Circuit For Short

1. Remove upper instrument panel cover as

described in Note 44a, if not done previously.

2. Disconnect 18-way connector at back of instrument panel cluster case, if not done previously.

3. Use the following table to identify the wiring color code of the circuit and perform the necessary preliminary steps needed to check the circuit for shorts.

Sender or Switch Circuit	Wire Color Code	Preliminary Steps
Fuel Gage (Sender Side)	18 Tan	Disconnect wire at connector inside license plate mounting door. On 693 styles, disconnect tan feed wire connector inside trunk.
Trunk Lid (Switch Side)	18 Dark Green	Disconnect wire at deck lid.
Low Brake (Switch Side)	18 Tan	Disconnect 18 Tan wire at low brake indicator switch.
Oil Pressure Tell-Tale (Sender Side)	18 Dark Blue	Disconnect 18 Dark Blue wire at oil pressure switch.
Temperature Tell-Tale (Sender Side)	18 Dark Green	Disconnect 18 Dark Green connector at thermogage unit.
"Eng. Temp." Tell-Tale	18 Violet with White	Disconnect 18 Dark Green with White wire at cylinder head unit.

4. To check the circuit, touch one lead of a test lamp that is self-powered to terminal at wiring harness connector of affected circuit and ground other lead. Test lamp should not light. If it does light, trace the wiring from the affected sender or switch and repair short in wiring by using chassis circuit diagram at back of this section.

e. Checking Printed Circuit

If an open circuit cannot be found using the procedures previously described, check the affected circuit as outlined below.

1. Remove upper instrument panel cover as described in Note 44a if not previously removed.

2. If bulbs are all right, remove instrument panel cluster assembly as described in Note 46a.

3. Examine the printed circuit affected for signs of damage using Fig. 12-32. If necessary, a self-powered test lamp may be used to check the continuity of these circuits. Check both the feed or hot circuit and the ground, switch or sender feeds for the affected circuit. If defective, the printed circuit must be replaced as described in Note 54.

34. Speedometer Head Assembly

a. Disassembly

1. Remove speedometer head assembly as described in Note 55a.

2. Remove two dial retaining screws, being careful not to mar dial.

3. After recording mileage, remove two screws securing the plastic high beam tell-tale housing and lift out total odometer. Do not attempt to disassemble the odometer. It is serviced as a complete unit.

4. Lift out trip odometer with end spring on left side of shaft and interconnecting gear on right side.

5. Remove idler gear, trip odometer reset gear, bushing and odometer engaging spring by lifting shaft slightly on left and pulling out to remove.

6. Remove third gear retainer plate screw and plate, then remove trip odometer reset spring.

7. Remove odometer reset shaft.

8. With the third gear retainer plate screw and plate off lift out yellow third gear.

NOTE: Further disassembly requires removal of field plate and speed cup assembly and subsequent recalibration of speedometer. If speedometer tester is not available for recalibration, repairs needing disassembly beyond this point should be referred to a United Motors Service Station.

9. Carefully remove white painted aluminum pointer assembly (press fit). Turn against zero stop and lightly lift pointer assembly at hub.

10. Remove two screws securing jewel plate. Remove jewel plate.

11. Remove two screws securing field plate to

frame and remove field plate and speed cup by lifting out by the speed cup spindle.

12. Inspect second gear for signs of damage. Do not remove unless necessary, as usually this gear will break while being removed. If necessary, remove second gear as follows:

a. Place bushing side of frame on wood block, but be certain bushing area is not obstructed by wood block.

b. Insert 1/8" punch or rod inside frame and against rear of bushing.

c. Carefully drive out bushing.

NOTE: Further disassembly, such as removal of the magnet shaft from frame, and speed cup assembly is not recommended.

b. Assembly

1. If removed, position second gear in frame assembly with gear end contacting worm gear on magnet shaft. Install by tapping bushing squarely into frame with rawhide mallet or similar tool until end play is .005" to .025".

2. Position third (yellow) gear with bevel gear end engaging worm gear end on second gear.

3. Install trip odometer reset shaft, position reset shaft return spring so that spring is actuated when shaft is depressed.

4. Holding spring in position, install retainer plate and screw, being sure second gear is in plate hole.

5. Position the shaft containing the idler gear, trip odometer reset gear and odometer engaging spring in frame, engaging the right end into the frame hole first.

6. Make sure trip odometer is clean of fingerprints by wiping with a lintless cloth or soft chamois.

7. Install trip odometer with end spring and interconnecting gear, making sure slotted ears of pinion carriers fit in positioning slot in frame.

8. Wipe total odometer clean of fingerprints with a lintless cloth or soft chamois.

9. Install total odometer, making sure slotted ears of pinion carriers fit in positioning slot in frame.

10. Secure odometers by installing the high beam tell-tale housing and two screws.

11. If removed, install speed cup and field plate by holding speed cup spindle and guiding assembly onto dowels. Retain with two screws and tighten uniformly.

NOTE: Make sure speed cup stop tab is on correct side of field plate so as to permit needle rotation. Hairspring coil on speed cup must be evenly spaced when in wound position. It may be necessary to use tweezers to adjust coils. Move regulator arm to horizontal position, if necessary, so that maximum adjustment may be made in either direction during calibration.

12. If removed, install jewel plate with cup end

up. Place one drop of rislone-type oil in jewel. Carefully wipe off excess oil.

13. Rotate all odometer wheels to the top of their travel.

14. Position speedometer dial on dowels, and secure with two screws.

15. Mount pointer on tapered spindle so that it points at approximately 30 MPH and twist back to, and in line with, "O" graduation while pressing down lightly. Tap pointer very lightly with handle end of screwdriver to secure in position.

16. Check for secure pointer to spindle contact by inserting a short piece of speedometer cable with proper tip in drive end of speedometer. An initial fast spin of test cable should swing pointer to approximately 30 MPH and then briskly return to "O". Perform this test several times. If pointer becomes loose on spindle, repeat step 15.

17. If during the performance of step 16, pointer returns to "O" intermittently or not at all, this indicates a speed cup and magnet assembly defect.

18. If field plate and speed cup assembly were removed, calibrate speedometer assembly, following the instructions furnished by the manufacturer for the speedometer tester being used.

19. Install speedometer head assembly as described in Note 55b.

35. Directional Signal Switch Service

The switch that operates the front fender cornering light is integral with the directional signal switch. It is part of the switch block included in the switch assembly, and is serviced with the switch.

Automatic canceling of the turn signal lights and cornering lights when lit is achieved by means of a cam connected to the steering wheel hub and a ratchet that is integral with the switch assembly. When the steering wheel is turned in the direction for which the control is set, the cam passes the ratchet without engaging, but when the wheel is turned in the opposite direction, the cam engages the ratchet and cancels the signal and cornering light.

The signal flasher, which is identical for both columns, is a sealed non-adjustable unit located on the lower steering column cover. If inoperative, it must be replaced. The flasher makes an audible signal when the circuit is energized. This serves as an additional warning that the signal is operating.

When the signal system is operating properly, the lights flash about 75 to 105 times per minute at 12.8 volts. If either a front or rear turn signal bulb burns out, the reduced current in the circuit will cause the remaining signals on that side of the car to burn steadily.

36. Directional Signal and Hazard Warning Switches

a. Removal (Standard Wheel)

1. Disconnect negative battery cable.

2. Perform steps 1 through 7 and 10 through 15 of Note 20a, Section 9.

b. Installation (Standard Wheel)

1. Perform steps 10 and 11, 13 through 16, and 18 through 29 of Note 20f, Section 9.

2. Connect negative battery cable.

c. Removal (Tilt and Telescope Wheel)

1. Disconnect negative battery cable.
2. Perform steps 1 through 14 of Note 24, Section 9.

d. Installation

1. Perform steps 21 through 32 of Note 24i Section 9.
2. Connect negative battery cable.

37. Horn Operation and Testing

Conditions that may affect horn performance and procedures for checking these conditions are listed below:

a. Horn Inoperative

1. Depress cushion on inner side of steering wheel. Horn should blow. If horn fails to blow, proceed as outlined below.

2. While horn is energized, tap horn lightly. If horn blows, proceed to step 3. If horn fails to blow, refer to step 6 of this procedure.

3. Release cushion so that horn will stop blowing.

4. Energize horn again. If horn blows normally, a particle of foreign material between the contact points caused the trouble and no adjustment is necessary.

5. If horn still fails to blow until tapped, turn adjustment screw, Fig. 12-33, one full turn counterclockwise with pliers.

CAUTION: This adjustment is sensitive. Do not turn screw more than one full turn or in wrong direction (clockwise). Misadjustment will require removing horn for adjustment on bench as described in Section d of this note.

6. Check horn for normal operation and if still inoperative, perform the following checks.

a. Connect a jumper lead to "H" and middle terminals of horn relay.

b. If horn blows, trouble is in relay, horn control or wiring.

c. To determine whether relay, horn control, or wiring is at fault, ground "S" terminal of relay.

d. If horn blows, horn control or wiring is at fault.

e. If horn does not blow and wiring between battery and relay is not defective, connect a voltmeter between horn terminal and horn mounting nut.

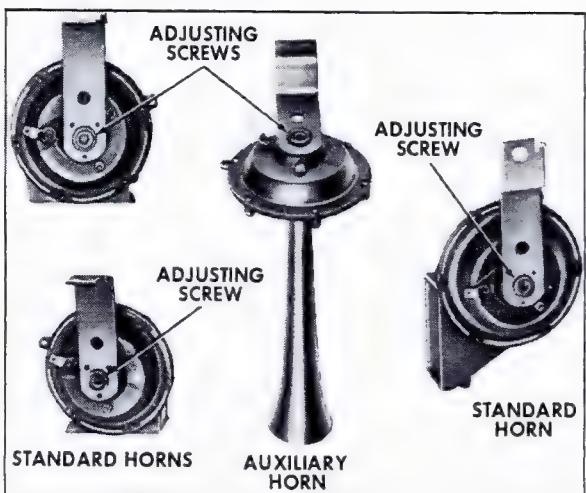


Fig. 12-33 Horn Adjusting Screw

- f. Connect a jumper lead to "H" and middle terminals of relay and note voltmeter reading.
- g. If no voltmeter reading is obtained, wiring between relay and horn is open or horn is not grounded.
- h. If voltmeter reading is less than 7.0 volts, trouble is due to high resistance connections in battery connection, wiring or faulty horn.
- i. If voltmeter reading is above 7.0 volts, trouble is due to a faulty horn. In this case, test horn for current draw.
- j. If no trouble is located during these checks and horn is still inoperative, remove horn for a bench check.

b. Horn Tone Poor

- 1. Harsh tone - caused by loose bolts in sheet metal mounting area.
- 2. Low pitch roar - sounds like "moo-ing" and is caused by too high a current. Horn needs adjusting.
- 3. Weak tone - caused by too low a current. Horn needs adjusting.
- 4. Weak strained tone - foreign body in horn trumpet that should be shaken out or removed.
- 5. Harsh vibration - caused by horn touching sheet metal. Bracket should be bent to give horn clearance and freedom from interference.

c. Horn Blows Constantly

- 1. This can be caused by a sticking horn relay.
- 2. Horn relay may be energized by grounded or shorted wiring.

NOTE: Most horns with burned open winding are caused by one of the above malfunctions. Before replacing horns with open windings with new horns, make sure that none of the above conditions exists, or the horn winding will again burn open.

d. Bench Checks

- 1. Measure current draw of horn while horn is operating. Current draw for each horn should be

between 4.5 and 5.5 amperes at 11.5 to 12.5 volts.

2. No current may indicate a broken connection or an open circuit due to a broken lead or to overheating. Most horn failures are caused by horns being operated continuously, which develops sufficient heat to melt the wires in the winding, causing an open circuit. Overheating is accompanied by a characteristic odor which indicates that horn should be replaced.

3. No current can also indicate that the contact points are open and a current adjustment is required. Turn adjusting screw counterclockwise.

4. High current, over 20 amperes, indicates an overheated winding or shorted horn which should be replaced.

5. A reading of approximately 18 amperes for a 12-volt horn indicates a condition in which the contact points are not opening. A current adjustment is required by turning the adjusting screw clockwise.

e. Current Adjustment

Turn adjusting screw, Fig. 12-33 counterclockwise to increase current or clockwise to decrease current until specified current is reached. Care must be taken not to turn the adjusting screw too far. Turn screw 1/4 of a turn at one time. If adjustment loosens the screw excessively, it may be staked with a punch.

f. Cold Weather Adjustment

If horn fails to blow in cold weather, it is possible that current limit is set too low although still within 4.5 - 5.5 ampere limit (each horn) at 12.0 volts. Turn adjusting screw 1/4 turn counterclockwise (90°) to increase draw, Fig. 12-33.

CAUTION: This adjustment should not be made unless horn fails to blow. A current increase on a properly operating horn can result in complete failure of unit.

38. Horn Contact Assembly

a. Removal

1. Remove steering wheel as described in Section 9, Note 18a.
2. Pull contact assembly from plastic tower in wheel.

NOTE: On the Tilt and Telescope wheel, remove spring on back of wheel by twisting off.

b. Installation

1. Install contact assembly into plastic tower on wheel.

NOTE: On the Tilt and Telescope wheel, install spring on back of wheel by twisting into place.

2. Install steering wheel as described in Section 9, Note 18b.

39. Clock Regulation and Resetting

The accuracy of automobile clocks operating on direct current should not be compared too closely with that of electric clocks operating on alternating current. The frequency of alternating current is controlled and corrected constantly at the power source, thereby eliminating accumulation of errors. A car clock is spring-operated and electrically wound. Time errors are accumulated day by day.

An automobile clock is considered a good time piece when at normal temperatures the consistent gain or loss does not exceed seven minutes per week. Accumulation of this error can amount to as much as thirty minutes during a month.

The owner must anticipate resetting the hands occasionally. This should be explained to owners at new car delivery. It is possible to regulate the clock so that the variation will be less than seven minutes weekly if care is taken as described below.

The reset knob projects from the center of the lower edge of the clock. To reset, push reset knob all the way in and turn until hands are at desired time. Keep the reset knob fully pushed in during adjustment, otherwise, automatic regulator may not engage. Resetting clock in either direction will automatically regulate clock to run approximately 20 seconds per day faster or slower, depending on which way clock is set. Resetting the clock slower does not harm the clock in any way. If more than a 20 second adjustment is required, resetting the clock after 12 hours have elapsed will give an additional 20 seconds slower or faster.

The special oils used to lubricate automotive clocks tend to deteriorate with age. If time-keeping characteristics of the clock become erratic, it should be removed and sent to the clock manufacturer's authorized clock repair station for cleaning and re-oiling. Cleaning and re-oiling is recommended at least once every two years.

40. Back-Up Light and Neutral Switch Removal and Installation

The neutral switch, back-up light switch, and parking brake vacuum release valve are combined into one unit mounted on the steering column under the instrument panel.

a. Removal

1. Place transmission shift lever in NEUTRAL detent.
2. Remove screw in clamp and carefully remove switch and clamp from steering column being careful not to disturb position of contact carrier.
3. Mark position of contact carrier, Fig. 12-34.
4. Mark top vacuum hose for identification and remove hoses.
5. Disconnect two wiring connectors from switch.

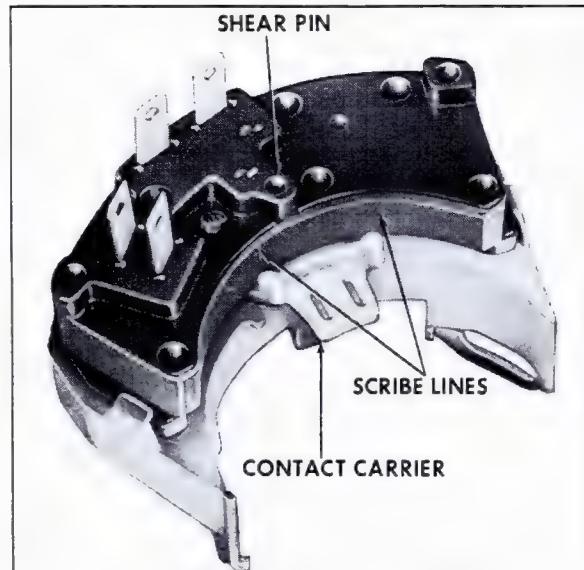


Fig. 12-34 Neutral Switch in Neutral

b. Installation

1. Place transmission shift lever in NEUTRAL detent.
2. Connect two wiring connectors to switch.
3. Move contact carrier on switch assembly to neutral position as marked during removal, Fig. 12-34. If necessary to install a new switch, the switch will be secured in neutral by a shear pin. Do not break pin.
4. Install switch assembly on steering column, aligning contact carrier blade with slot in shift tube. With switch tight against column, slide switch down column until bosses on casting rest on bottom edge of slot in outer jacket. Bosses extend below the mounting surface.
5. Place clamp on switch and install screw to tighten clamp, making sure that shift lever is in NEUTRAL detent while this operation is performed.
6. Connect vacuum hoses to switch as marked during removal.
7. Switch should now be properly adjusted. If new switch was installed, a slightly greater effort to position the shift lever in any position besides neutral will be necessary, because it will be necessary to break the shear pin. Check operation as described in step 1 of Note 41.

41. Back-Up Light and Neutral Switch Adjustment

Check transmission linkage adjustment as described in Section 7, Note 4, on all but 693 style or Note 22 on 693 style before adjusting switch.

1. Switch should operate as described below:
 - a. Engine should start in PARK and NEUTRAL positions only.
 - b. Back-up lights should operate when transmission shift lever is placed in REVERSE position.

INSTRUMENT PANEL

c. Parking brake should release in any drive range with engine running.

A vacuum leak that can be corrected by moving the shift lever is an indication that the switch is improperly adjusted and not defective. The switch should be adjusted in this situation. Adjust as described below:

2. Loosen screw on clamp securing switch to steering column.

3. Place transmission shift lever in NEUTRAL detent.

4. Adjust switch until engine starts in NEUTRAL detent. Tighten clamp screw and test

operation as described in step 1.

42. Electrical Accessory Installation

When installing additional electrical equipment, such as Rear Window Defogger or Twilight Sentinel, connect this equipment to the proper terminals in the wiring harness or the accessory terminal on the fuse panel in accordance with the instructions provided with the accessory. Care should be exercised in installing accessories other than those that are Cadillac designed to avoid over-loading the electrical system.

GENERAL DESCRIPTION

INSTRUMENT PANEL

The instrument panel for 1969 is illustrated in Fig. 12-35. The service information portion of this section includes procedures for the removal and installation of all components that can be considered a part of, or attached to, the instrument panel assembly used on all 1969 Cadillac cars. The procedures for actual disassembly, assembly, testing, or adjustment of the various components are covered in specific sections of this manual where they apply.

The starter switch is combined with the steering column and shift lever lock, located on the right side of the steering column below the steering wheel, and is mechanically connected to the ignition switch located on the steering column jacket below the instrument panel. The engine is started by turning the key clockwise against spring tension to energize the starter solenoid.

When the engine starts, releasing the key permits it to return to the "RUN" position. All accessories are disconnected in the "START" position.

The ignition lock has five key positions -- "ACCESSORY" - "LOCK" - "OFF" - "RUN" - and "START". The "LOCK" position is clearly marked on the left side of the lock cylinder and is coordinated with the pointer on the ignition knob. The transmission shift lever must be in "PARK" position and the ignition knob in "LOCK" position before the key can be inserted or removed. This locks the steering wheel and transmission shift lever as well as the ignition system.

The "OFF" position allows the engine to be shut off without locking the steering wheel, thus, the car can be steered or towed in case of any problem requiring turning off the ignition. The "RUN" position completes the ignition circuit

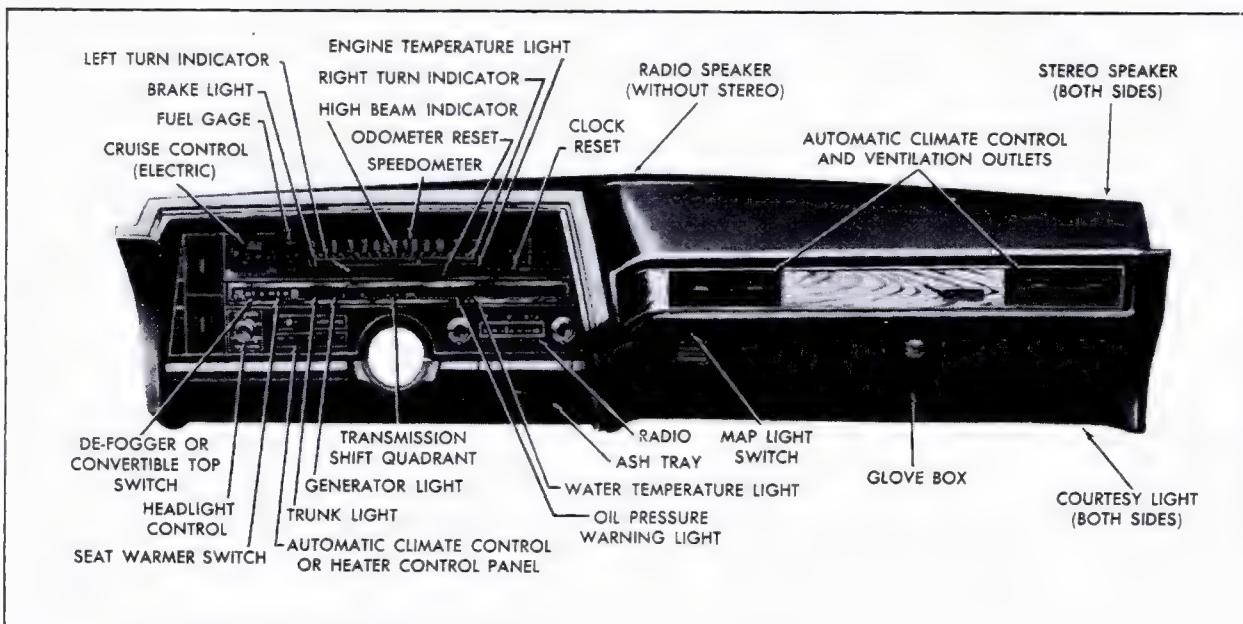


Fig. 12-35 Instrument Panel Assembly

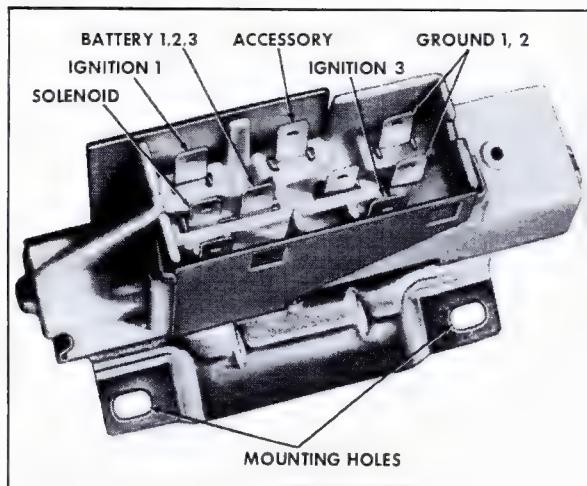


Fig. 12-36 Ignition Switch

and activates all instruments and accessories.

The "ACCESSORY" position allows the use of accessories with the ignition off.

The switch also features a buzzer system to warn the driver to remove the key from the lock. If the driver's door is opened with the key in the lock and the switch in the "OFF", "LOCK", or "ACCESSORY" position, a relay buzzes and the Engine Temperature Warning light is illuminated as a reminder that the key has not been removed from the lock.

The fuse panel, Fig. 12-37, is mounted under the instrument panel to the right of the radio. The following fuses are located in this panel: cigar lighters, clock, courtesy lights, glove box light, map light, chauffeur light on 697 styles, trunk light, ash tray light, cornering, parking, and

front side marker lights, back-up lights, Cruise Control lights, turn signals, rear window defogger, transmission downshift solenoid, fuel gage, tell-tale lights, heater and air conditioner, antenna, instrument panel lights, radio, stop lights and Hazard Warning flasher, tail lights, license light, and windshield wipers and washer.

A circuit breaker is provided in the fuse panel for the convertible top, horns, power seat, and power windows. On cars equipped with heater only, a 15 amp fuse is used, while a 25 amp fuse is used on cars equipped with Automatic Climate Control. The Hazard Warning flasher and the turn signal flasher are located on the rear side of the steering column lower cover.

The chassis wiring diagrams are illustrated at the end of this section. To simplify removal and installation for service replacement, the major portion of chassis wiring is divided into two separate harnesses: the under hood harness and the instrument panel. These harnesses are protected by fusible links in the wiring and fuses in the fuse panel.

Fusible links are placed in the power feed circuits in the engine compartment, and are designed to open up before the instrument panel or body feed wiring, ahead of the fuse panel, is damaged in case of shorts.

All 1969 instrument panels utilize a printed circuit on the back of the instrument panel cluster assembly. It is connected to the car wiring through a multiple terminal connector which is plugged into the back side of the cluster. The printed circuit permits removal of all bulbs and sockets without any wire or terminal removal.

43. Fuse Replacement

The fuse panel is located under the lower instrument panel to the right of the radio receiver unit. Fuses can be replaced by reaching up under the panel. The fuse block and fuse locations are shown in Fig. 12-37. The lower rated fuses installed in all 1969 Cadillacs are color-striped according to the following chart:

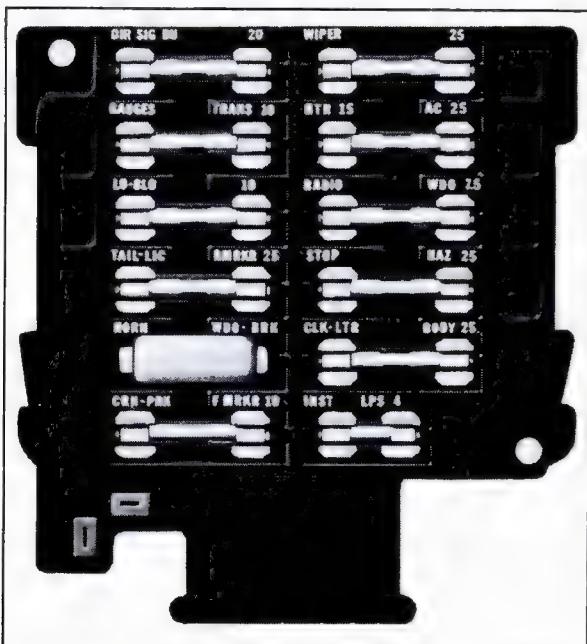


Fig. 12-37 Fuse Panel

Fuse	Application	Color Stripe
Heater (15 amp)	All except 697 and except air conditioning	Lt. Blue
Radio (7-1/2 amp)	All cars	Brown
Trans. and Instruments (10 amp)	All cars	Red
Cornering, Front Side Marker, and Parking Lamps (10 amp)	All cars	Red

For service replacement, unstriped common fuses of same amperage and size can be used.

44. Instrument Panel Top Cover (Fig. 12-38)

a. Removal

1. Disconnect negative battery cable at battery.
2. Working under instrument panel, disconnect radio speaker connection near radio.
3. Remove three Phillips head screws securing the right and left windshield pillar garnish moldings and remove moldings.
4. Working inside glove box, remove two screws and washers securing top cover to instrument panel.
5. Remove three screws securing top cover to instrument panel bezel assembly.

NOTE: Screws should be removed in this order (two screws in glove box first) to prevent damage to plastic bosses if stresses are present in the panel.

6. Lift up lightly and pull the top cover rearward to disengage from cowl.

NOTE: On cars equipped with a tilt wheel, removal can be facilitated by placing the wheel in low position.

7. Raise top cover high enough for access, and disconnect the Twilight Sentinel Photocell above cluster assembly.
8. Remove cover.

b. Installation

1. Hold top cover over instrument panel and connect the Twilight Sentinel photocell above cluster assembly.

2. Position top cover on panel, aligning screw holes in bezel and glove box opening.

3. Install three screws securing top cover to instrument panel bezel assembly.

4. Working inside glove box, install two screws

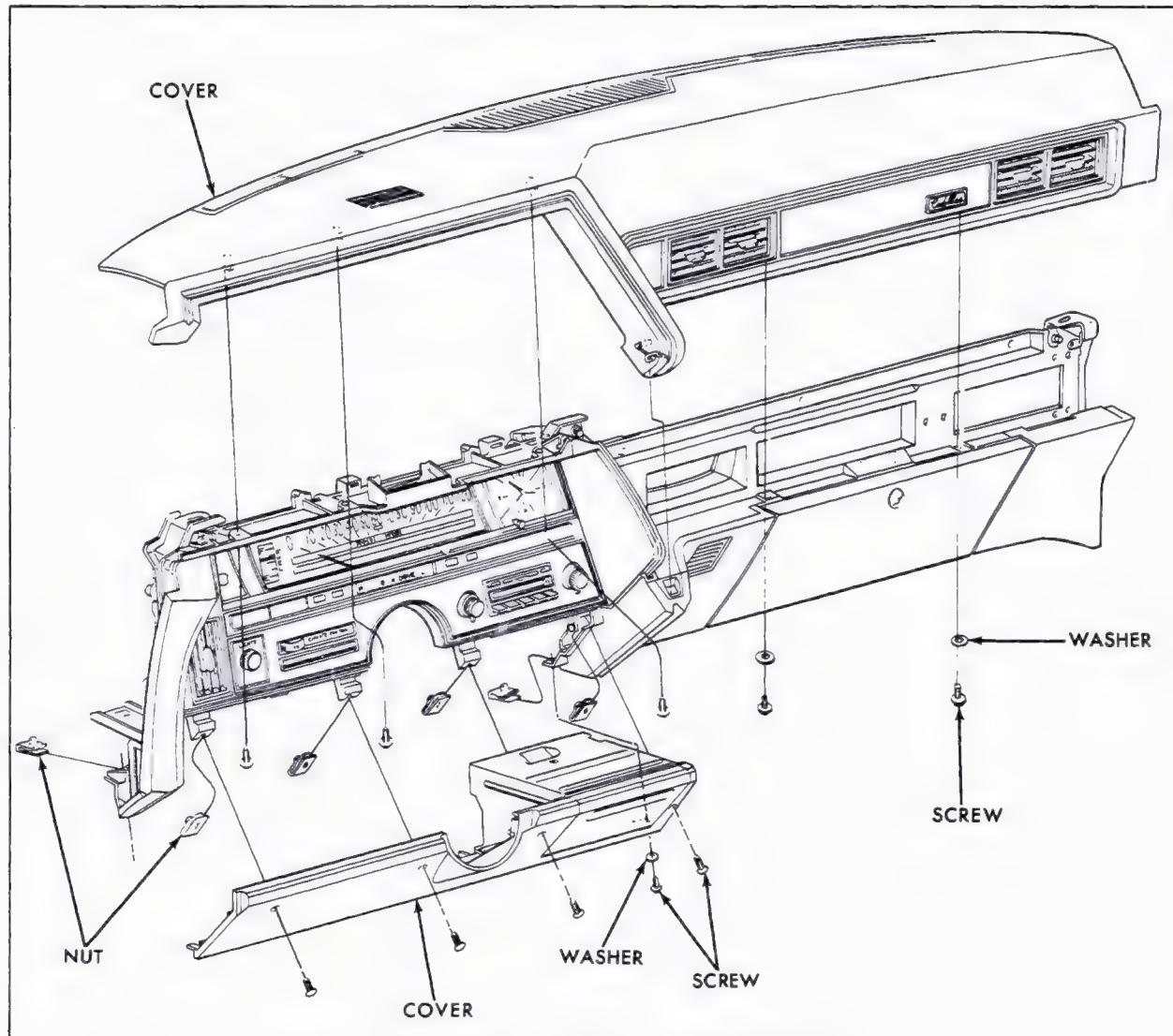


Fig. 12-38 Instrument Panel - (Cover Disassembled)

and washers securing top cover to instrument panel.

NOTE: Screws should be installed in this order (three screws above bezel first) to prevent damage to plastic bosses if stresses are present in the panel.

5. Install right and left windshield pillar garnish moldings and secure each with three Phillips head screws.

6. Working under instrument panel, connect radio speaker connection near radio.

7. Connect negative battery cable at battery.

45. Steering Column Lower Cover (Fig. 12-38)

a. Removal

1. Disconnect negative battery cable at battery.

2. Remove four Phillips head screws securing lower cover to instrument panel bezel assembly.

3. Loosen two screws securing lower cover to lower instrument panel.

4. Disengage lower cover by pulling up and out to gain access to wiring connections on rear side of cover.

5. Disconnect ash tray wiring and Twilight Sentinel amplifier if car is so equipped. Remove courtesy light bulb and socket from housing.

6. Remove turn signal flasher unit and hazard warning flasher unit from clips on rear side of cover.

7. Remove cover.

b. Installation

1. Install turn signal and hazard warning flasher units in clips on rear side of cover.

2. Connect wiring to ash tray and Twilight Sentinel amplifier if car is so equipped. Install courtesy light bulb and socket into housing.

3. Position steering column lower cover over two screws securing cover to lower instrument panel.

4. Install four Phillips head screws securing lower cover to instrument panel bezel assembly.

5. Tighten two screws securing cover to lower instrument panel.

6. Connect negative battery cable at battery.

46. Instrument Panel Cluster

a. Removal

1. Disconnect negative battery cable at battery.

2. Remove instrument panel top cover as described in Note 44a.

3. Remove clock as described in Note 56a.

4. Remove radio as described in Note 63a.

5. Remove steering column lower cover as described in Note 45a.

6. Remove screw securing shift indicator pointer to steering column and remove pointer.

7. Remove odometer reset knob by pulling it off the shaft.

8. Remove four screws securing cluster to bezel assembly.

9. Move cluster forward and to the right. Tip right hand corner of cluster downward and remove cluster from under instrument panel, similar to radio removal.

b. Installation

1. Slide cluster up into position from under panel.

2. Install four screws securing cluster to bezel assembly.

3. Install odometer reset knob by positioning the "D"-shaped clip inside the knob to align with the flat on the shaft and push the knob onto the shaft.

4. Install shift indicator pointer on steering column and secure with one screw.

5. Install steering column lower cover as described in Note 45b.

6. Install radio as described in Note 63b.

7. Install clock as described in Note 56b.

8. Install instrument panel top cover as described in Note 44b.

9. Connect negative battery cable at battery.

47. Instrument Panel Bezel Assembly (Fig. 12-40)

a. Removal

1. If car is equipped with tilt wheel, put wheel in low position.

2. Remove instrument panel top cover as described in Note 44a.

3. Remove steering column lower cover as described in Note 45a.

4. Remove radio as described in Note 63a.

5. Remove two screws securing left hand air conditioner duct to bezel and remove duct.

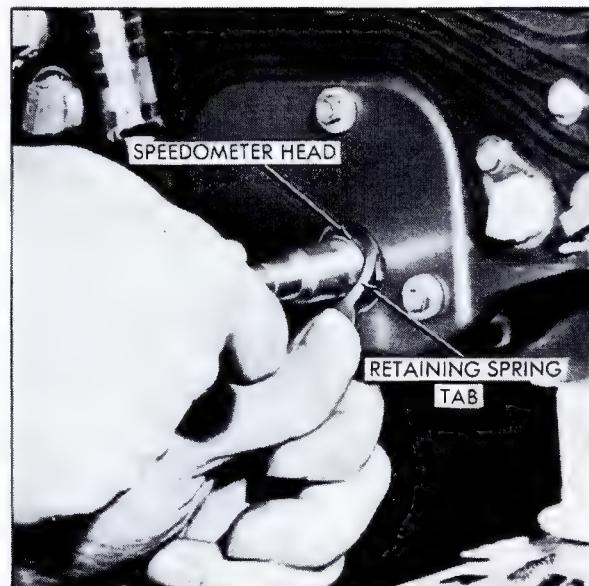


Fig. 12-39 Speedometer Cable

6. If car is equipped with Cruise Control remove two screws securing selector assembly to bezel and push assembly back out of bezel.

7. Loosen two nuts on upper steering column support and allow column to drop as far as possible without removing the nuts.

CAUTION: Do not remove nuts, as column may bend under its own weight if not supported.

8. Remove screw securing shift indicator pointer to steering column and remove pointer.

9. Disconnect the following electrical and vacuum connections depending upon the manner in which the car is equipped:

- a. Wiring connector to Automatic Climate Control sensor.
- b. Vacuum connector, electrical connectors, and light on Automatic Climate Control control panel.
- c. Electrical connector and two lights in clock.
- d. Wiring connector and two lights to headlight switch.
- e. Twilight Sentinel connector.
- f. Guide-matic connector.

g. Rear Window Defogger or convertible top switch connector.

h. Seat Warmer Switch connector.

i. Instrument cluster connector.

j. Two ground wires on left side of bezel.

10. Disconnect speedometer cable from speedometer head by depressing retaining spring tab on speedometer head, Fig. 12-39.

11. Remove the following screws, Fig. 12-40:

- a. Screw securing bezel assembly to instrument panel.

- b. Two screws securing bezel to instrument panel center support.

- c. Screw securing bezel to instrument panel frame above left air conditioning outlet.

- d. Screw securing bezel to instrument panel frame under headlight switch.

12. Using care to avoid damage, remove bezel assembly by lifting upward and working right side free from instrument panel.

13. See Notes 48, 49, and 50 when replacing any part of the bezel assembly.

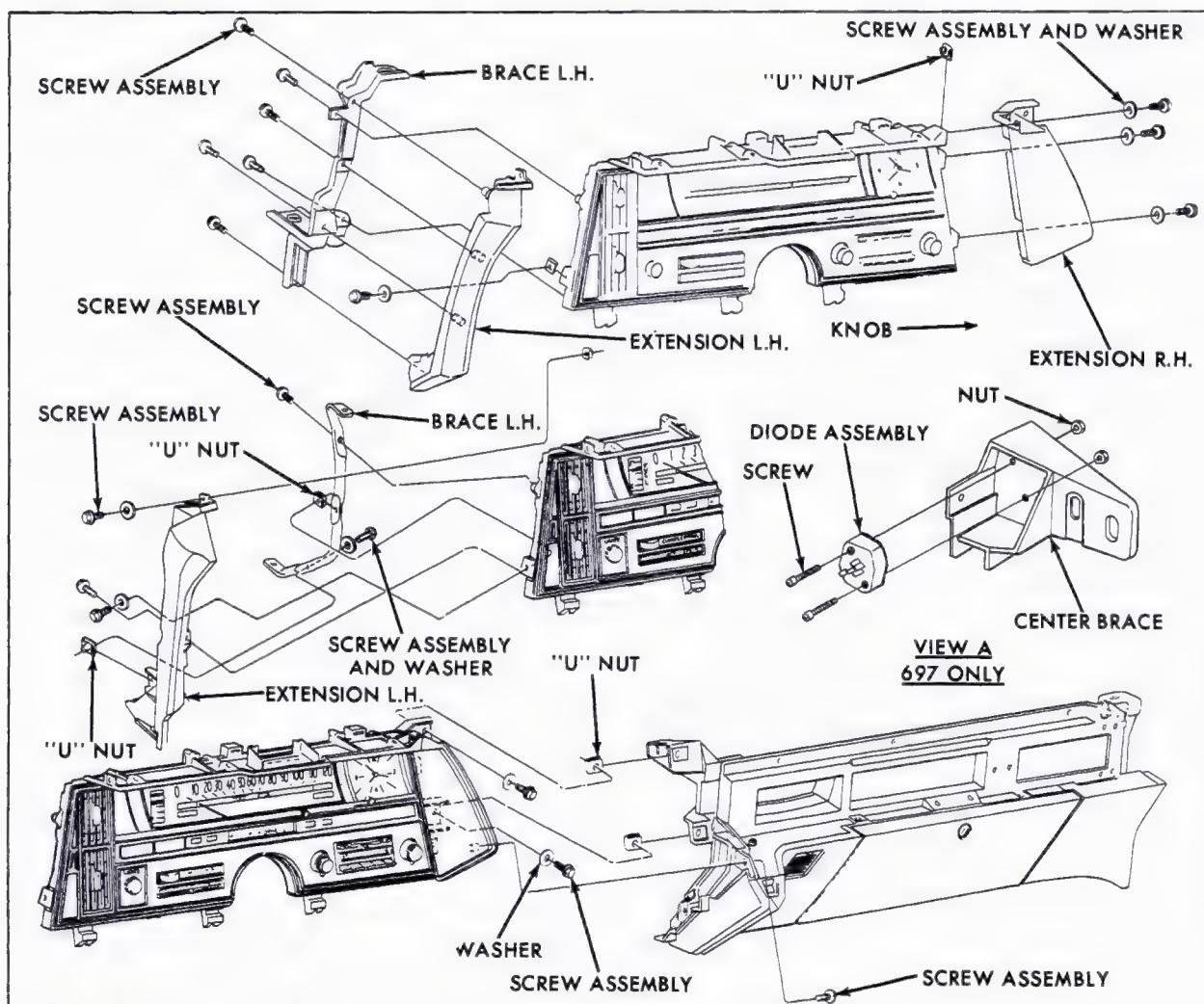


Fig. 12-40 Instrument Panel - (Bezel)

b. Installation

1. Place bezel assembly in position, and loosely install the following screws, Fig. 12-40:
 - a. Screw securing bezel to instrument panel frame above left air conditioning outlet.
 - b. Two screws securing bezel to instrument panel center support.
 - c. Screw securing bezel to instrument panel frame under headlight switch.
 - d. Screw securing bezel assembly to instrument panel.
2. Align bezel as necessary. When aligned, tighten the five attaching screws.
3. Connect speedometer cable at speedometer head by pushing cable on head, making sure that retaining ring snaps into place on ferrule.

NOTE: If the spring does not engage the ferrule, separate the ferrule from the speedometer neck, rotate the speedometer input shaft approximately 1/8 turn and repeat the initial operation.

4. Connect the following electrical and vacuum connections, depending upon the manner in which the car is equipped:
 - a. Wiring connector to Automatic Climate Control sensor.
 - b. Vacuum connector, electrical connectors, and light on Automatic Climate Control panel.
 - c. Electrical connector and two lights in clock.
 - d. Wiring connector and two lights to headlight switch.
 - e. Twilight Sentinel connector.
 - f. Guide-Matic connector.
 - g. Rear Window Defogger or convertible top switch connector.
 - h. Seat Warmer Switch connector.
 - i. Instrument cluster connector.
 - j. Two ground wires on left side of bezel.
5. Install shift indicator pointer and secure to steering column with one screw.
6. Raise steering column into position and tighten two nuts on upper steering column support.
7. If car is equipped with Cruise Control, install selector unit into bezel and secure with two screws.
8. Install left hand air conditioning duct and secure to bezel with two screws.
9. Install radio as described in Note 63b.
10. Install steering column lower cover as described in Note 45b.
11. Install instrument panel top cover as described in Note 44b.

48. Instrument Panel Bezel (Center Section) (Fig. 12-40)**a. Removal**

1. Remove instrument panel bezel assembly as described in Note 47a, and place on workbench.
2. Remove cluster assembly as described in Note 46a.

3. Remove headlight switch assembly by removing three screws.

4. Remove four screws securing Climate Control control panel to bezel and remove control panel.

5. Remove clock from bezel as described in Note 56a.

6. Remove Rear Window Defogger, convertible top, and Seat Warmer switches, if car is so equipped.

7. Remove left extension as described in Note 49a.

8. Remove right extension as described in Note 50a.

b. Installation

1. Install Rear Window Defogger, convertible top, and Seat Warmer switches if car is so equipped.

2. Install clock as described in Note 56b.

3. Install Climate Control control panel and secure with four screws.

4. Install headlight switch assembly and secure with three screws.

5. Install cluster assembly as described in Note 46b.

6. Install right extension as described in Note 50b.

7. Install left extension as described in Note 49b.

8. Install bezel assembly as described in Note 47b.

49. Instrument Panel Bezel Extension (Left Side) (Fig. 12-40)**a. Removal**

1. Remove instrument panel bezel assembly as described in Note 47a, and place on workbench.

2. Remove six screws securing instrument panel brace to extension and remove brace.

3. Remove two screws and washers securing extension to bezel and remove extension.

b. Installation

1. Secure extension to instrument panel bezel with two screws and washers.

2. Position instrument panel brace on extension and secure with six screws.

3. Install instrument panel bezel assembly as described in Note 47b.

50. Instrument Panel Bezel Extension (Right Side) (Fig. 12-40)**a. Removal**

1. Remove instrument panel bezel assembly as described in Note 47a, and place on workbench.

2. Remove three screws and washers securing extension to bezel and remove extension.

b. Installation

1. Install extension to bezel and secure with three attaching screws and washers.
2. Install instrument panel bezel assembly as described in Note 47b.

51. Instrument Panel—Right Side (Fig. 12-41)

a. Removal

1. Remove instrument panel top cover as described in Note 44a.
2. Disconnect light and electrical connection to map light housing.
3. Disconnect glove box light and right hand courtesy light.
4. If car is equipped with electric trunk lock, open glove box door and remove nut securing switch to glove box housing. Remove trunk lock switch from glove box housing.
5. Remove three screws securing air conditioning duct to right hand air conditioning outlet.
6. Loosen six screws on steering column lower

cover so cover can be pulled out slightly when panel is removed.

7. Remove screw and washer securing instrument panel strut support to instrument panel.

8. Remove the following screws as shown in Fig. 12-41:

- a. Screw securing right instrument panel to bezel assembly.
- b. Three screws securing instrument panel to instrument panel center support.
- c. Two screws securing instrument panel to instrument panel brackets on right side of panel.
9. Remove wiring harness from clips along top of panel.
10. Pull panel out and disconnect ground wire to map light. Remove panel.

b. Installation

1. Place panel in position and connect ground wire to map light.

2. Install the following screws as shown in Fig. 12-41:

- a. Three screws securing instrument panel to instrument panel center support.

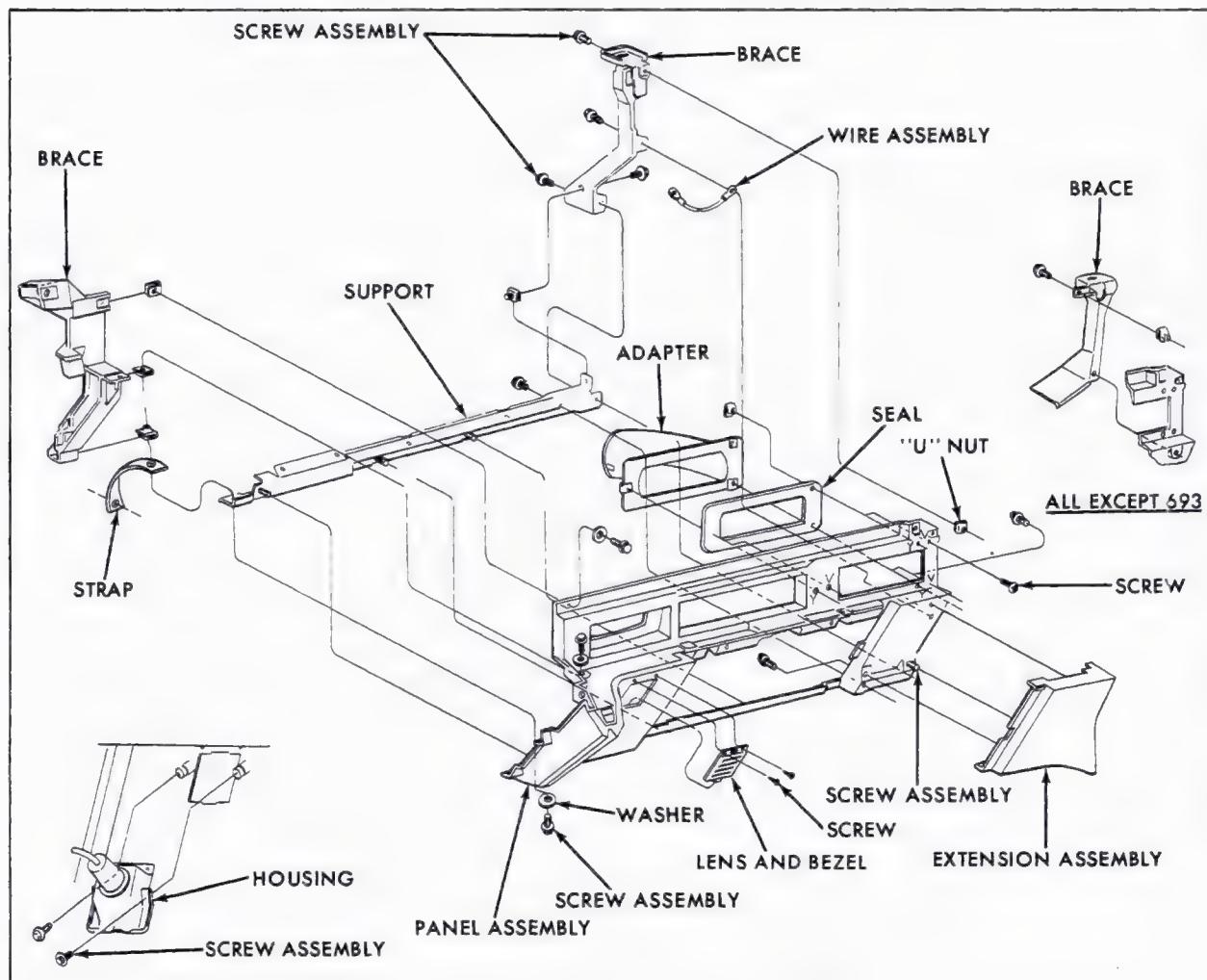


Fig. 12-41 Instrument Panel - (Right Side)

- b. Two screws securing instrument panel to instrument panel brackets on right side of panel.
- c. Screw securing instrument panel to bezel assembly.
- 3. Install wiring harness in clips along top of panel.
- 4. Install screw and washer securing instrument panel strut support to instrument panel.
- 5. Tighten six screws on steering column lower cover.
- 6. Secure right hand air conditioning duct to right hand air conditioning outlet with three screws.
- 7. If car is equipped with electric trunk lock, open glove box door and install switch.
- 8. Connect glove box light and right hand courtesy light.
- 9. Connect electrical connection and light socket to map light housing.
- 10. Install instrument panel top cover as described in Note 44b.

52. Instrument Panel Extension—Right Side (Fig. 12-41)

a. Removal

- 1. Remove right side of instrument panel as explained in Note 51a and place on workbench.
- 2. Remove two screws securing glove box hinge to panel and remove glove box assembly.
- 3. Remove three screws securing extension to instrument panel and remove extension.

b. Installation

- 1. Install three screws securing extension to instrument panel.
- 2. Place glove box assembly in panel and secure hinge to panel with two screws.
- 3. Install right side of instrument panel as explained in Note 51b.
- 4. Align glove box door.

53. Instrument Panel Center Support

a. Removal

- 1. Remove instrument panel top cover as described in Note 44a.
- 2. Remove right side of instrument panel as described in Note 51a.
- 3. On 697 styles, remove compressor diode as described in Note 76a.
- 4. Remove two screws and washers securing support to bezel assembly.
- 5. Remove two screws securing fuse panel brace to center support.
- 6. Remove two screws and washers securing support to instrument panel frame on firewall.
- 7. Remove one screw securing radio brace to center support.
- 8. Pull wiring harness and radio ground strap away from support and remove support.

b. Installation

- 1. Put support in position and install two screws and washers securing support to instrument panel frame on firewall.

NOTE: The front screw should also secure the radio ground strap to the brace.

- 2. Secure wiring harness to support.
- 3. Install two screws and washers securing support to bezel assembly.
- 4. Install one screw securing radio brace to center support.
- 5. Install two screws securing fuse panel brace to center support.
- 6. On 697 styles, install compressor diode as described in Note 76b.
- 7. Install right side of instrument panel as described in Note 51b.
- 8. Install instrument panel top cover as described in Note 44b.

54. Instrument Panel Printed Circuit (Fig. 12-32)

a. Removal

- 1. Remove instrument panel cluster as described in Note 46a, and place face down on a workbench.
- 2. Remove 14 sockets and bulbs from cluster case.
- 3. Snap off fuel gage protective cover and remove two screws securing printed circuit flap to fuel gage.
- 4. Remove four screws and washers securing printed circuit to back of cluster case and remove printed circuit.

NOTE: No attempt should be made to repair this circuit. If inoperative, it should be replaced.

b. Installation

- 1. Position printed circuit on back of cluster case and secure with four screws and washers.
- 2. Install two screws securing printed circuit flap to fuel gage.

NOTE: Care must be taken to install printed circuit beneath fuel gage conductor strips, otherwise gage will be inoperative.

- 3. Install 14 sockets and bulbs into cluster case.
- 4. Install instrument panel cluster assembly as described in Note 46b.

55. Speedometer Head Assembly

a. Removal

- 1. Remove cluster assembly as described in Note 46a.
- 2. Remove six clips securing cluster lens to cluster case and remove lens.
- 3. Open staking along lower edges and remove

sheet metal retainer and shift indicator dial.

4. Remove three screws that secure speedometer head assembly to cluster case and place assembly with back of cluster case on workbench.

5. Lift speedometer head assembly out of cluster case.

b. Installation

1. With back of cluster case on workbench, set speedometer head assembly into case.

2. Install three screws securing speedometer head assembly to cluster case.

3. Place retainer and cluster lens on cluster case. Secure with six retaining clips and restake across lower edge.

4. Install cluster assembly as described in Note 46b.

56. Clock Assembly

a. Removal

1. Disconnect negative battery cable at battery.
2. Remove two Phillips head screws and plate securing top of clock to bezel assembly.

3. Push up on top of clock while holding bottom in. When clock snaps out, tilt clock assembly back and remove from bezel.

4. Remove two bulbs and disconnect wires to clock.

b. Installation

1. Connect wires to clock and install two bulbs into housing.

2. Position clock assembly in bezel and snap into place. Clock should be tilted so bottom is positioned first.

3. Position plate and install two Phillips head screws securing top of clock to bezel assembly.

4. Connect negative battery cable at battery.

57. Headlight Control Switch Assembly

a. Removal

1. Remove instrument panel top cover as described in Note 44a.

2. Remove steering column lower cover as described in Note 45a.

3. Remove two screws securing left hand air conditioning duct to bezel assembly and remove duct and outlet.

4. Disconnect wiring harness running below headlight switch assembly.

5. Depress spring loaded release button on top of headlight switch and remove headlight switch, knob and rod assembly.

6. Remove three screws securing switch assembly to bezel. One screw is located on top and the other two on the bottom.

7. Pull headlight switch assembly rearward, disconnect wiring harness connectors, two bulbs and remove assembly.

b. Installation

1. Position switch assembly and connect wiring harness connectors and two bulbs.

2. Install three screws securing switch assembly to bezel.

3. Insert knob and rod assembly into headlight switch. When assembly is fully inserted, the rod will snap into place.

4. Connect wiring harness running below headlight switch assembly.

5. Position left hand air conditioning outlet in bezel and install duct, securing it to bezel with two attaching screws.

6. Install steering column lower cover as de-

7. Install instrument panel top cover as described in Note 44b.

58. Headlight Switch (Fig. 12-42)

a. Removal

1. Remove headlight control switch assembly as described in Note 57a.

2. Separate lens and backplate from case and headlight switch.

3. Remove hex head sleeve securing headlight switch to housing case and remove switch from case.

b. Installation

1. Install headlight switch on headlight control switch housing case, aligning tang on switch with locating notch in housing case.

2. Install hex head sleeve securing headlight switch to housing case.

3. Install backplate and lens on housing case and headlight switch assembly.

4. Install headlight control switch assembly as described in Note 57b.

59. Headlight Switch Housing—Without Guide-Matic and/or Twilight Sentinel

a. Disassembly

1. Remove headlight control switch assembly as described in Note 57a.

2. Separate case and headlight switch assembly.

3. Remove hex head sleeve securing backplate to lens, washer and escutcheon and separate these parts.

4. Remove hex head sleeve securing case to headlight switch and separate these parts.

b. Assembly

1. Install headlight switch on housing case and secure with hex head sleeve.

2. Position lens, washer and escutcheon on backplate and secure with hex head sleeve.

3. Install housing case and headlight switch assembly on backplate and lens.

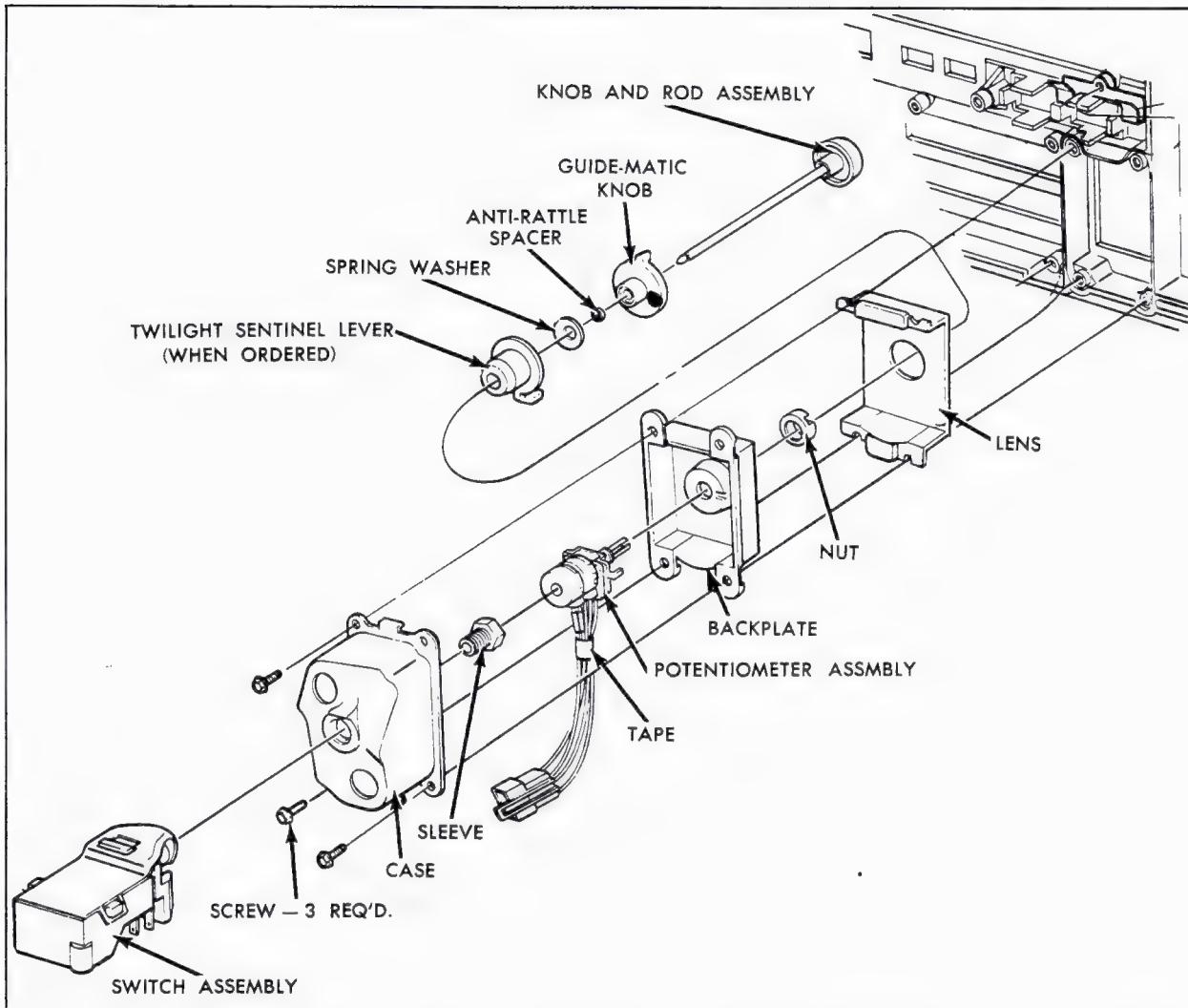


Fig. 12-42 Light Switch - (Disassembled)

4. Install headlight switch assembly as described in Note 57b.

60. Guide-Matic or Twilight Sentinel Control Switch

NOTE: On cars equipped with both options, a dual control switch with an inner and outer shaft is used.

a. Removal

1. Remove headlight control switch assembly as described in Note 57a.

2. Separate backplate and lens.

3. Remove spring-loaded control ring and anti-rattle washer on cars equipped with Twilight Sentinel or Guide-Matic only.

NOTE: On cars equipped with both options, remove Guide-Matic spring-loaded control ring, spacer, and spring washer from dual control switch inner shaft and Twilight Sentinel control lever from outer shaft.

4. Remove spanner nut securing control switch to backplate using Spanner•Nut Wrench, J-6968, Fig. 12-43, and remove control switch from backplate.

b. Installation

1. Install control switch on backplate, aligning notch in backplate with tang on control switch. Secure with spanner nut using Spanner Nut Wrench, J-6968, Fig. 12-43.

2. Install anti-rattle washer and spring-loaded control ring (Guide-Matic or Twilight Sentinel only).

NOTE: On cars equipped with both options, install Twilight Sentinel Control lever on dual control switch outer shaft and spring washer, spacer, and Guide-Matic spring-loaded control ring on inner shaft.

3. Install housing case and headlight switch assembly on backplate and lens, positioning control switch wires at bottom of backplate.

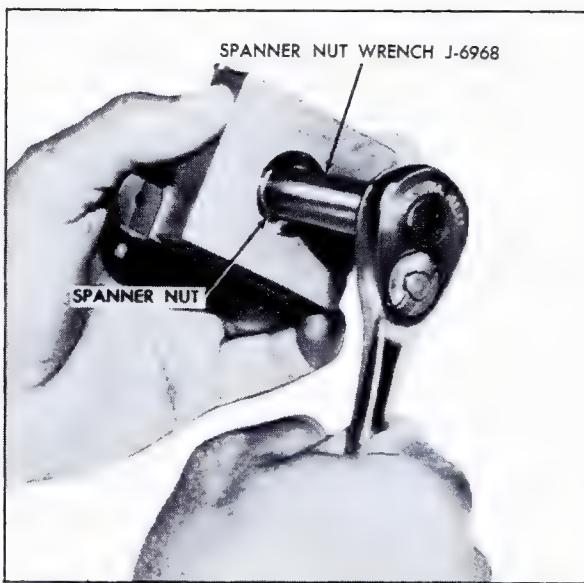


Fig. 12-43 Removing Spanner Nut - Control Switch

4. Install headlight control switch assembly as described in Note 57b.

61. Fuel Gage

a. Removal

1. Remove instrument panel top cover as described in Note 44a.
2. Remove plastic snap-in cover from top of fuel gage.
3. Remove four screws on top of fuel gage and position printed circuit flap out of way.
4. Push wiring harness back and lift gage straight up, tipping top toward rear of car, to remove.

b. Installation

1. Push wiring harness back and install fuel gage into top of cluster case.
2. Position printed circuit flap on top of gage and install four screws on top of gage.

NOTE: The printed circuit flap must be under the metal fuel gage conductor strips, otherwise the gage will not operate.

3. Install plastic snap-in cover on top of fuel gage.
4. Install instrument panel top cover as described in Note 44b.

62. Ignition Switch (Fig. 12-36)

a. Removal

1. Disconnect negative battery cable at battery.
2. Position lock cylinder in "lock" position.
3. Remove steering column lower cover as described in Note 45a.
4. Loosen two nuts on upper steering column

support and allow column to drop as far as possible without removing the nuts.

CAUTION: Do not remove nuts, as column may bend under its own weight.

5. Disconnect ignition switch connector at switch.
6. Remove two screws securing ignition switch to steering column and remove switch.

b. Installation

1. Assemble ignition switch on actuator rod and adjust to the "lock" position.

NOTE: The lock position can be found by holding the switch actuating rod stationary with one hand, then moving the switch towards the bottom of the column with the other hand until the end of travel in the switch has been reached. This is the accessory position. Next, back off one detent in the switch and this will be the lock position. Make sure the ignition key is in the lock position, then assemble the ignition switch to the column using the two screws provided. Take care to assure proper engagement of drive rod and switch slider without moving from "lock" position. Tighten screws to 35 inch-pounds.

2. Connect ignition switch connector at switch.
3. Tighten two nuts on upper steering column.
4. Install steering column lower cover as described in Note 45b.

5. Connect negative battery cable at battery.

63. Radio Receiver Unit

a. Removal

1. Remove steering column lower cover as described in Note 45a.
2. On all cars except the Eldorado, remove defroster hose behind radio.
3. Remove radio knobs, wave washers, and control rings by pulling straight out.
4. Using Spanner Nut Wrench, J-6968, remove spanner nuts securing control shafts to instrument panel, Fig. 12-44.

5. Disconnect five-way power connector, antenna lead-in cable, and the following connectors if car is so equipped:

- a. Single speaker lead to rear speaker on stereo equipped cars.
- b. Two-way speaker connector on AM or AM/FM equipped cars.
- c. Four-way connector to front speakers on stereo equipped cars.
- d. Audio amplifier unit connector on stereo equipped cars.
6. Remove two hex head screws securing lower support bracket to radio and instrument panel center support and remove bracket.

7. Pull receiver unit back from instrument panel to disengage control shafts and lower to gain access to dial bulb.

8. Disconnect dial bulb socket from radio and remove radio receiver unit.

b. Installation

1. Install dial bulb socket into receiver unit and position unit in instrument panel.

2. Support receiver unit and install spanner nuts snugly on control shafts. Tighten spanner nuts using Spanner Nut Wrench, J-6968, Fig. 12-44.

3. Install lower support bracket and secure with two hex head screws, one to receiver unit and one to instrument panel center support.

4. Connect five-way power connector, lead-in cable, and the following connectors if car is so equipped:

a. Single speaker lead to rear speaker on stereo equipped cars.

b. Two-way speaker connector on AM and AM/FM equipped cars.

c. Four-way speaker connector on stereo equipped cars.

d. Audio amplifier unit connector on stereo equipped cars.

5. Install control rings, wave washers, and radio knobs by pressing on.

6. On all cars except the Eldorado, install defroster hose behind radio.

7. Install steering column lower cover as described in Note 45b.

64. Audio Amplifier Unit

a. Removal

1. Disconnect negative battery cable at battery.
2. Disconnect audio amplifier unit connector at receiver unit.



Fig. 12-44 Removing Radio Control Knob Nut

3. Open glove box door and remove one screw on left flange of glove box opening.

4. Remove two screws securing audio amplifier to lower instrument panel.

5. With glove box door open, guide audio amplifier unit out behind glove box opening.

b. Installation

1. Position audio amplifier unit behind lower instrument panel and loosely install two screws securing audio amplifier to lower panel.

2. With glove box door open, install screw on left flange of glove box opening.

3. Tighten two screws securing audio amplifier to lower instrument panel.

4. Connect audio amplifier unit connector to receiver unit.

5. Connect negative battery cable at battery.

65. Radio Front Speaker

a. Removal

1. Remove instrument panel top cover as described in Note 44a.

2. On all but AM/FM Stereo radios, remove four screws securing speaker to grille and remove front speaker, Fig. 12-45.

3. Remove either AM/FM Stereo radio front speaker by removing four Tinnerman nuts securing speaker to speaker grille, Fig. 12-45.

b. Installation

1. On all but AM/FM Stereo radios, position front speaker on instrument panel top cover and grille. Secure with four self-tapping screws, Fig. 12-45.

2. On either AM-FM Stereo radio front speaker, secure speaker to top cover and grille with four Tinnerman nuts, Fig. 12-45.

3. Install instrument panel top cover as described in Note 44b.

66. Cigar Lighter Base Assembly

a. Removal

1. Open ash tray door and remove cigar lighter and ash tray receptacle.

2. Remove four screws securing ash tray door to ash tray housing and remove door.

3. Disconnect ash tray housing bulb socket from shield and cigar lighter base feed wire from cigar lighter base.

4. Remove lighter base from sleeve by holding sleeve and rotating lighter base.

5. Remove lighter base from ash tray housing.

b. Installation

1. Position lighter base in ash tray housing.

2. Hold lighter sleeve in position and screw base into sleeve. Bulb shield must face up when tight to allow light to enter ash tray receptacle.

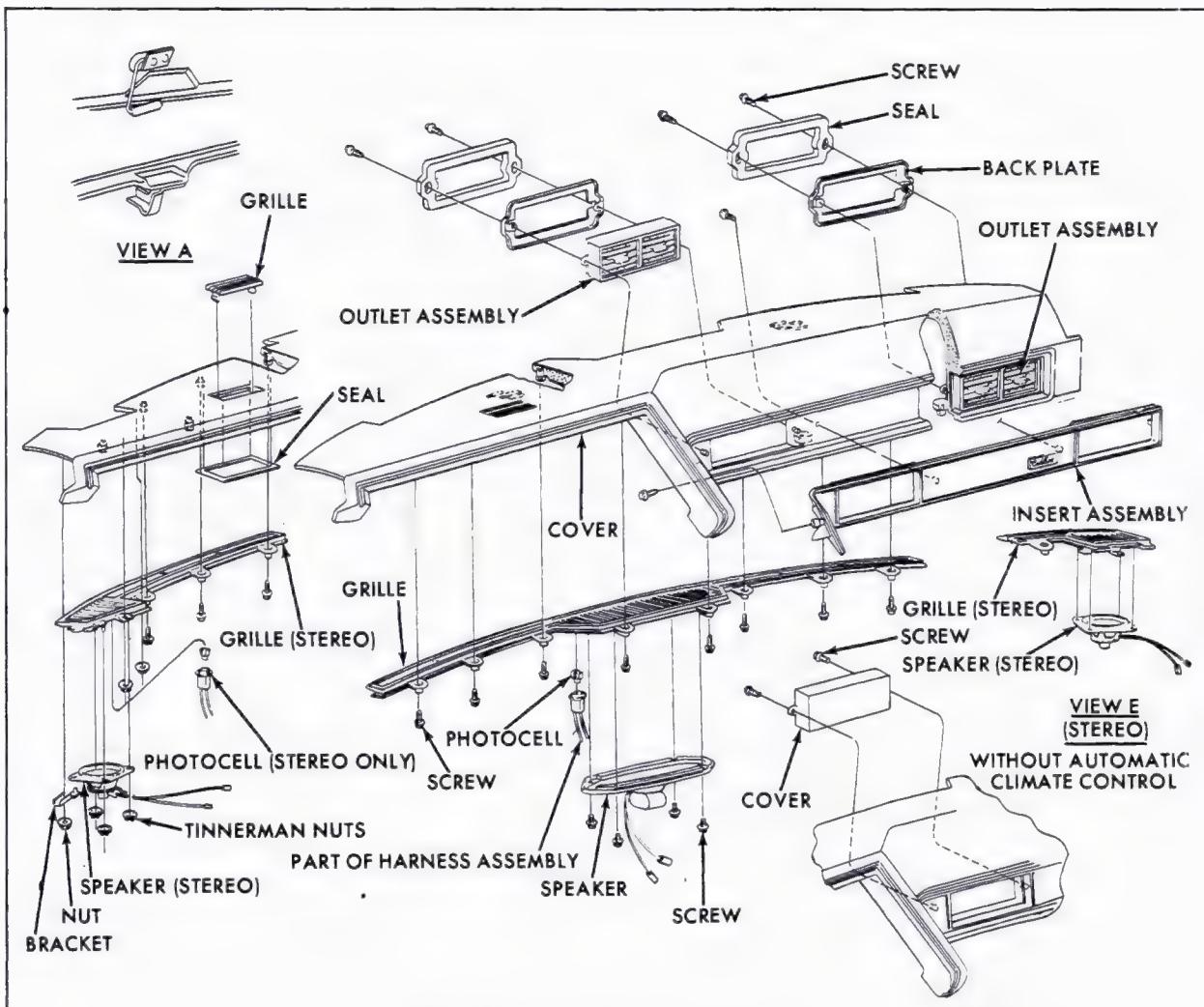


Fig. 12-45 Instrument Panel Top Cover

3. Connect ash tray housing bulb socket to shield and feed wire to cigar lighter base.
4. Position ash tray door on ash tray housing and secure with four attaching screws.
5. Install ash tray receptacle and cigar lighter into ash tray housing. Close ash tray door.

2. Install steering column lower cover as described in Note 45b.

68. Windshield Wiper and Washer Switch

a. Removal

1. Open left front door to gain access to screw securing control switch to instrument panel extension on door.
2. Loosen screw securing control switch to extension.

NOTE: Screw is trapped and cannot be removed.

3. Pull control switch out and disconnect electrical connector.

b. Installation

1. Connect electrical connector and place control switch into instrument panel extension on left front door.

67. Ash Tray Assembly

a. Removal

1. Remove steering column lower cover as described in Note 45a.
2. Remove four screws and two washers securing ash tray assembly to lower cover and remove assembly.

b. Installation

1. Position ash tray assembly on lower cover and secure with four screws and two washers.

2. From front of door, tighten screw securing control switch to extension.

69. Ventilation Control Cable and Knob Assembly (Right or Left) (693)

a. Removal

1. Remove two screws that secure knob to underside of lower instrument panel.
2. Pull cowl kick pad away from cowl.
3. Remove clip washer that holds bowden cable on control lever pins.
4. Remove bowden cable clamp screw and disconnect cable from control lever pin and cable clamp.

b. Installation

1. Install bowden cables on control lever pin and secure with clip washer.
2. Install bowden cable in cable clamp and tighten screw that holds cable clamp.
3. Reposition cowl kick pad.
4. Install two screws that secure knob to underside of lower instrument panel.

70. Heater Control Panel Assembly

a. Removal

1. Remove steering column lower cover as described in Note 45a.
2. Remove six port vacuum connector from bottom of heater control panel assembly.
3. Remove two screws securing strut from cowl to steering column and remove strut.
4. Remove two-way switch connector from bottom of assembly.
5. Remove four screws that secure assembly to lower instrument panel.
6. Pull assembly toward cowl and disconnect dial bulb socket and four-way switch connector from top of assembly.
7. Remove assembly from beneath lower instrument panel cover.

b. Installation

1. Position heater control panel assembly and connect dial bulb socket and one four-way switch connector at top.
2. Install assembly on lower instrument panel. Secure with four screws.
3. Connect two-way switch connector at bottom of assembly.
4. Install six port vacuum connector at bottom of assembly.
5. Install strut from cowl to steering column and secure with two screws.
6. Install steering column lower cover as described in Note 45b.

71. Automatic Climate Control Panel Assembly

a. Removal

1. Remove steering column lower cover as described in Note 45a.
2. Remove eight port vacuum connector from bottom of control panel assembly.
3. Disconnect wiring connector and bulb socket from control panel.
4. Remove two screws securing strut from cowl to steering column and remove strut.
5. Remove heater hose behind control panel to gain access to screws.
6. Working behind instrument panel, remove four screws securing control panel to bezel assembly.

NOTE: A 1/4" inch deep well socket should be used to remove the screws.

7. Pull control panel assembly toward cowl and disconnect two vacuum hose connections on top of panel.
8. Remove control panel assembly from beneath instrument panel.

b. Installation

1. Position control panel assembly and connect two vacuum hose connections on top of panel.
2. Install control panel in bezel and secure with four screws.

CAUTION: If screws are not installed straight, threads in bezel bosses may be stripped.

3. Connect wiring connector and bulb socket to control panel.
4. Connect eight port vacuum connector to bottom of control panel assembly.
5. Install heater hose removed during removal procedure.
6. Install strut from cowl to steering column and secure with two screws.
7. Install steering column lower cover as described in Note 45b.

72. Automatic Climate Control Sensor (In-Car)

a. Removal

1. Remove instrument panel top cover as described in Note 44a.
2. Remove two clips securing sensor to housing and remove sensor by lifting straight up.
3. Disconnect wires from rear of sensor.

b. Installation

1. Connect wires to rear of sensor.
2. Slide sensor down into housing and install two retaining clips.
3. Install instrument panel top cover as described in Note 44b.

73. Automatic Climate Control Side Air Outlet—Left Side

a. Removal

1. Remove instrument panel top cover as described in Note 44a.
2. Remove steering column lower cover as described in Note 45a.
3. Disconnect air conditioning hose from left hand outlet.
4. Remove two screws securing duct to bezel assembly and remove duct.
5. Pull outlet back toward cowl and remove over top of bezel.

b. Installation

1. Push outlet into bezel from behind bezel assembly.
2. Install air conditioning duct and secure to bezel with two attaching screws.
3. Install air conditioning hose on left hand outlet.
4. Install steering column lower cover as described in Note 45b.
5. Install instrument panel top cover as described in Note 44b.

74. Automatic Climate Control Side Air Outlet—Right Side

NOTE: The outer right side air outlet has a restricted travel so that air cannot be directed into the ash tray. When replacing this outlet, care should be used to insure that the proper outlet is used.

a. Removal

1. Remove instrument panel top cover as described in Note 44a.
2. Remove two screws securing outlet to top cover and remove outlet.

b. Installation

1. Insert side air outlet into top cover and secure with two attaching screws.
2. Install instrument panel top cover as described in Note 44b.

75. Automatic Climate Control Center Air Outlet

a. Removal

1. Remove instrument panel top cover as described in Note 44a.
2. Remove two screws securing outlet to top cover and remove outlet.

b. Installation

1. Insert center air outlet into top cover and secure with two attaching screws.
2. Install instrument panel top cover as described in Note 44b.

76. Compressor Diode Assembly (697 Styles Only) (Fig. 12-40)

a. Removal

1. Remove steering column lower cover as described in Note 45a.
2. Disconnect multiple connector at compressor diode assembly.
3. Remove two screws and nuts securing diode assembly to instrument panel center support and remove assembly.

b. Installation

1. Install two screws and nuts securing diode assembly to instrument panel center support.
2. Connect multiple connector at compressor diode assembly.
3. Install steering column lower cover as described in Note 45b.

77. Glove Box Liner (Fig. 12-46)

a. Removal

1. Open glove box door and remove six screws that hold glove box liner to glove box door.
2. Remove two screws that secure glove box door stop to door and remove stop.
3. Remove glove box liner.

b. Installation

1. Install glove box liner into glove box opening.
2. Install glove box door stop and secure with two attaching screws.
3. Align glove box liner with glove box door and secure liner to door with six attaching screws.

78. Glove Box Door (Fig. 12-46)

a. Removal

1. Remove glove box liner as described in Note 77a.
2. Remove three screws that hold glove box door to glove box door hinge and remove door.

b. Installation

1. Install glove box door on glove box hinge and secure with three attaching screws.
2. Install glove box liner as described in Note 77b.

79. Glove Box Lock (Fig. 12-46)

a. Removal

1. Remove glove box liner as described in Note 77a.
2. With door open, set fork bolt in closed position.
3. With key out, depress retainer through access hole on top of lock casing.

4. While retainer is depressed, insert key into lock and remove lock cylinder.
5. Remove escutcheon.
6. Remove washer, filler, and lock cylinder casing.

b. Installation

1. Install washer, filler, and lock cylinder casing into glove box door and secure with escutcheon.
2. Insert key into lock cylinder.
3. While holding the fork bolt in the closed position, depress retainer through access hole in top of lock casing and install lock cylinder.
4. Install glove box liner as described in Note 77b.

80. Cruise Control Selector Assembly

a. Removal

1. Disconnect negative battery cable at battery.
2. Release retainer spring from dust shield by turning 90 degrees. Pull control cable to release from adjustable coupling.
3. Attach a five-foot piece of wire or heavy string to disconnected end of control cable.

NOTE: Attaching the wire or string to end of control cable will insure cable being routed

properly when selector control assembly is reinstalled.

4. Remove instrument panel top cover as described in Note 44a.
5. Remove two screws at top of selector securing the assembly to instrument panel bezel and pull selector assembly up out of the retaining clip.
6. Remove top screw and loosen lower screw securing grommet retainer to firewall and remove split grommet.
7. Pull control cable through firewall from inside car. Pull just far enough to gain access to two wiring connectors in Cruise Control harness.
8. Disconnect two wiring connectors.
9. Pull selector assembly and control cable out of car.
10. Remove string or wire from end of control cable and leave in car.
11. If necessary, control cable may be adjusted as described in Section 15, Note 18.

b. Installation

1. Attach wire or heavy string, left in car during removal procedure to end of control cable.
2. Working from outside car, pull on wire or string to guide control cable through firewall, being careful not to bend or kink control cable.
3. Connect two wiring connectors on selector to dash and Cruise Control harness connectors.

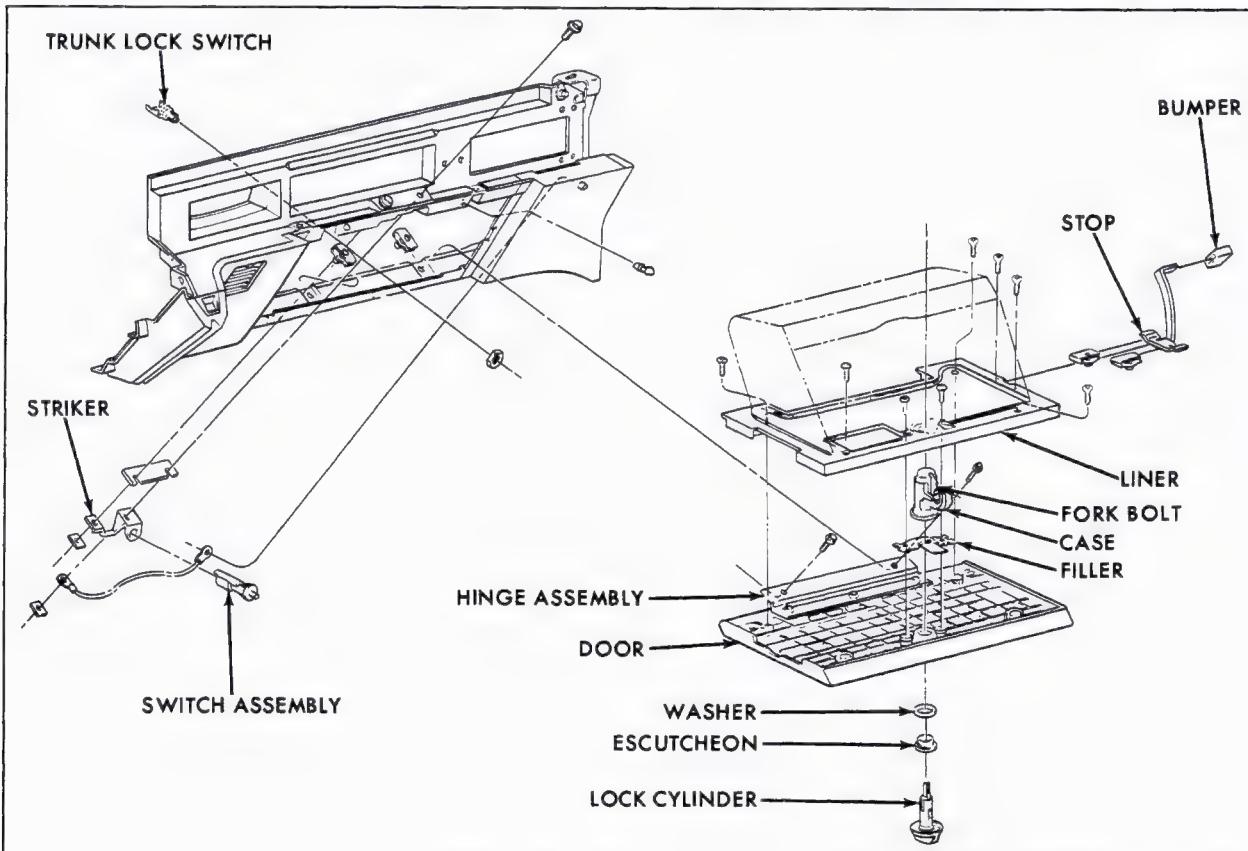


Fig. 12-46 Glove Box Disassembled

4. Install split grommet in retainer. Install top screw and tighten lower screw securing grommet to firewall.

5. Position selector control assembly in the retaining clip and install two screws securing selector control assembly to instrument panel bezel.

6. Install instrument panel top cover as described in Note 44b.

7. Remove wire or string from end of control cable.

8. Rotate speed selector to high speed setting and guide cable into dust shield until ferrule stops against dust shield. Hold in this position and rotate retainer spring on dust shield so that it engages ferrule through slots.

9. Rotate selector dial to low speed stop until spring snaps into adjustable coupling.

CAUTION: This step must be performed or unit will control in "ON" position or lock-in in "AUTO" position at low speed regardless of selected setting.

81. Cruise Control On-Off Switch (693)

a. Removal

1. Remove instrument panel top cover as described in Note 44a.

2. Disconnect two wiring connectors in harness attached to switch assembly.

3. Remove two screws securing on-off switch to bezel and remove on-off switch assembly.

b. Installation

1. Install on-off switch assembly into bezel and secure with two attaching screws.

2. Connect two wiring connectors in harness attached to switch assembly.

3. Install instrument panel top cover as described in Note 44b.

82. Twilight Sentinel Photocell

a. Removal

1. Remove instrument panel top cover as described in Note 44a and place on workbench.

2. Rotate plastic photocell holder counterclockwise to remove from underside of instrument panel top cover.

3. Remove photocell from plastic holder.

b. Installation

1. Insert photocell into plastic holder.

2. Install plastic holder into underside of instrument panel top cover by rotating clockwise.

3. Install instrument panel top cover as described in Note 44b.

83. Twilight Sentinel Amplifier

a. Removal

1. Remove two screws securing amplifier

bracket to steering column lower cover. One of the screws also secures the left hand courtesy lamp housing to the lower cover.

2. Disconnect connector at amplifier and remove amplifier with bracket attached.

3. Remove two screws securing amplifier to bracket and remove amplifier.

b. Installation

1. Install amplifier on bracket and secure with two screws.

2. Connect wiring connector at amplifier.

3. Position bracket and amplifier on lower cover and secure with two screws. The left hand screw also secures the left hand courtesy light housing to the lower cover.

84. Rear Window De-Fogger Blower Switch

a. Removal

1. Remove steering column lower cover as described in Note 45a.

2. Disconnect switch connector.

3. Squeeze retaining tabs together and pull switch out from front of bezel.

b. Installation

1. Slide switch into bezel until it snaps into place.

2. Connect switch connector.

3. Install steering column lower cover as described in Note 45b.

85. Seat Warmer On-Off Switch

a. Removal

1. Remove steering colum lower cover as described in Note 45a.

2. Disconnect switch connector.

3. Squeeze retaining tabs together and pull switch out from front of bezel.

b. Installation

1. Push switch into bezel until it snaps in place.

2. Connect switch connector.

3. Install steering column lower cover as described in Note 45b.

86. Convertible Top Switch

a. Removal

1. Remove steering column lower cover as described in Note 45a.

2. Disconnect switch connector.

3. Squeeze retaining tabs together and pull switch out from front of bezel.

b. Installation

1. Slide switch into bezel until it snaps in place.

2. Connect switch connector.
3. Install steering column lower cover as described in Note 45b.

87. Map Light Assembly

a. Removal

1. Disconnect negative battery cable at battery.
2. Reaching up from under instrument panel, loosen two screws securing housing to instrument panel.

3. Slide housing down to disengage from screws and remove assembly.
4. Disconnect wiring connector and remove bulb and snap in socket from housing.

b. Installation

1. Connect wiring connector and install bulb and socket into housing.
2. Slide housing up onto screws in instrument panel.
3. Tighten screws securing housing to instrument panel.
4. Connect negative battery cable at battery.

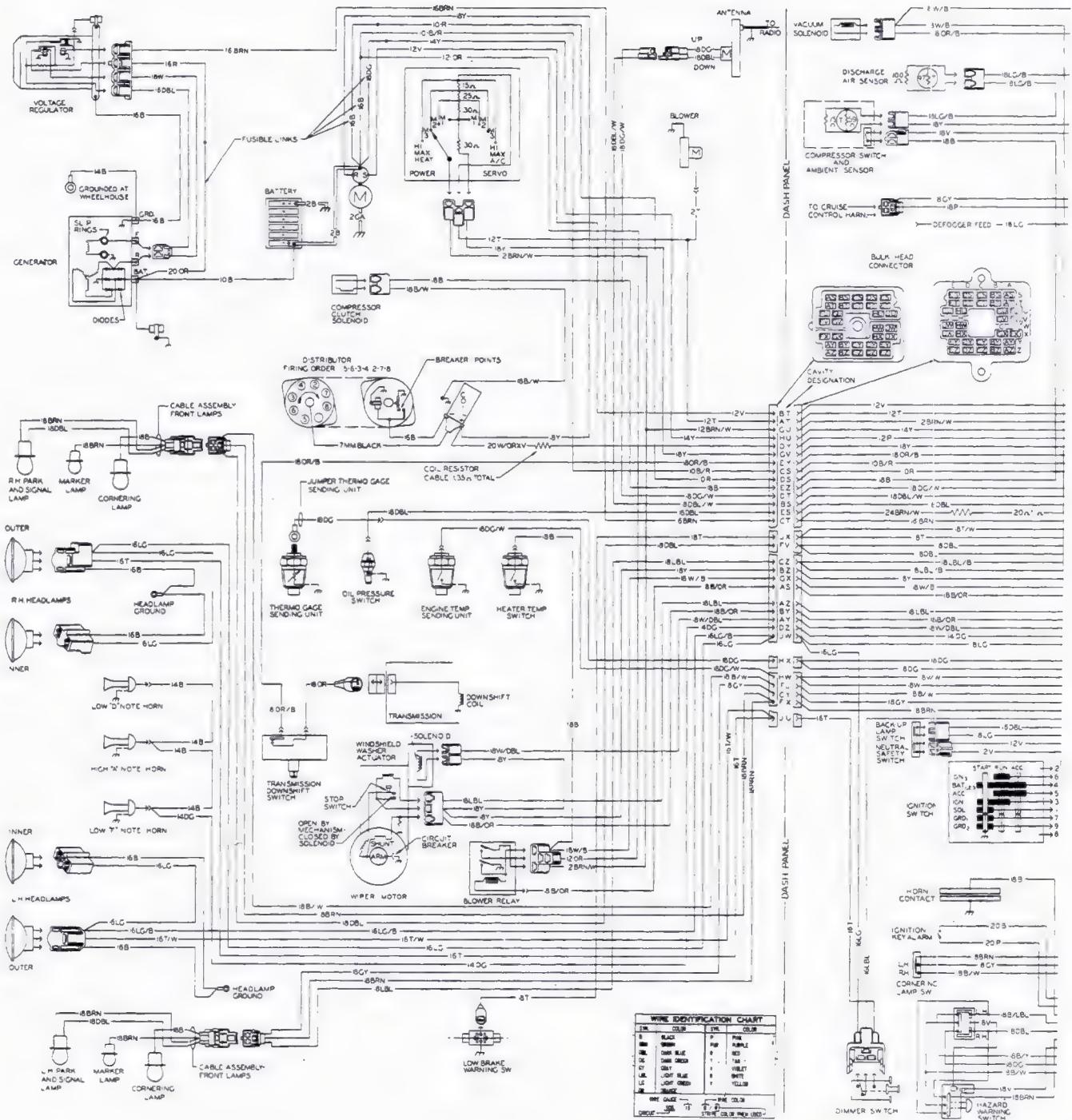


Fig. 12-47 Chassis Circuit Diagram (Exc. 693 & 697)

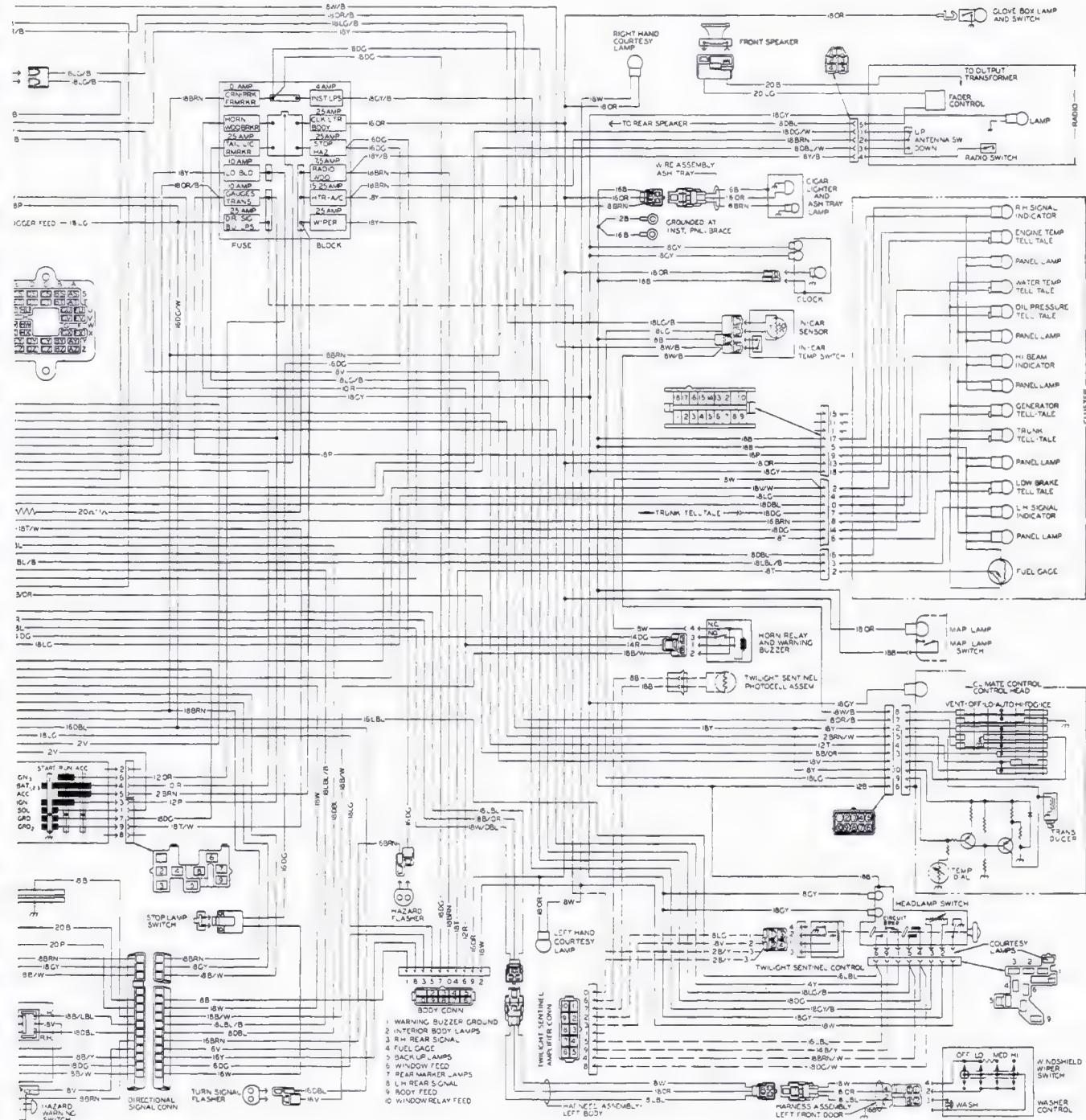


Fig. 12-47 Chassis Circuit Diagram (Exc. 693 & 697)

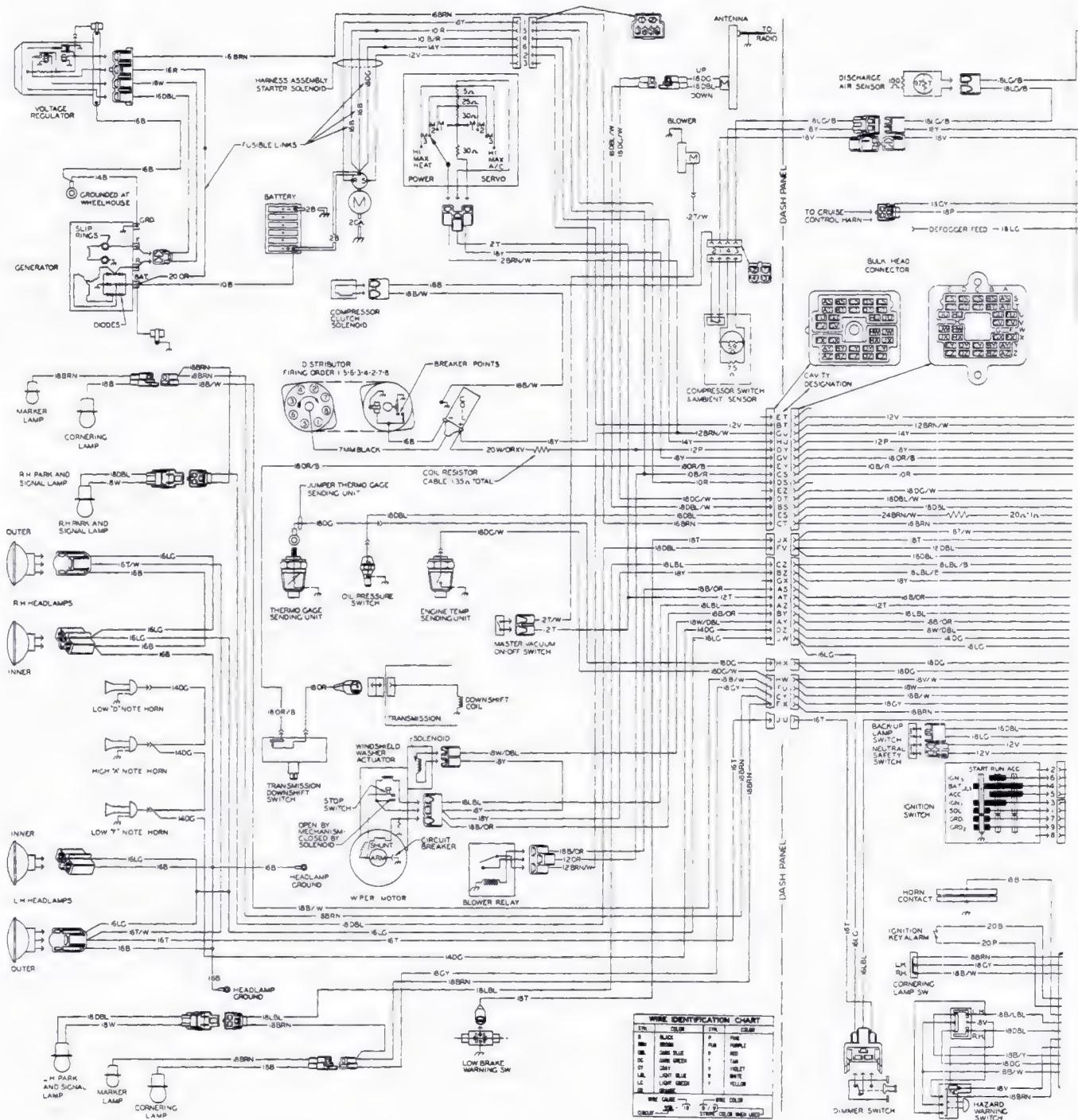


Fig. 12-48 Chassis Circuit Diagram (693)

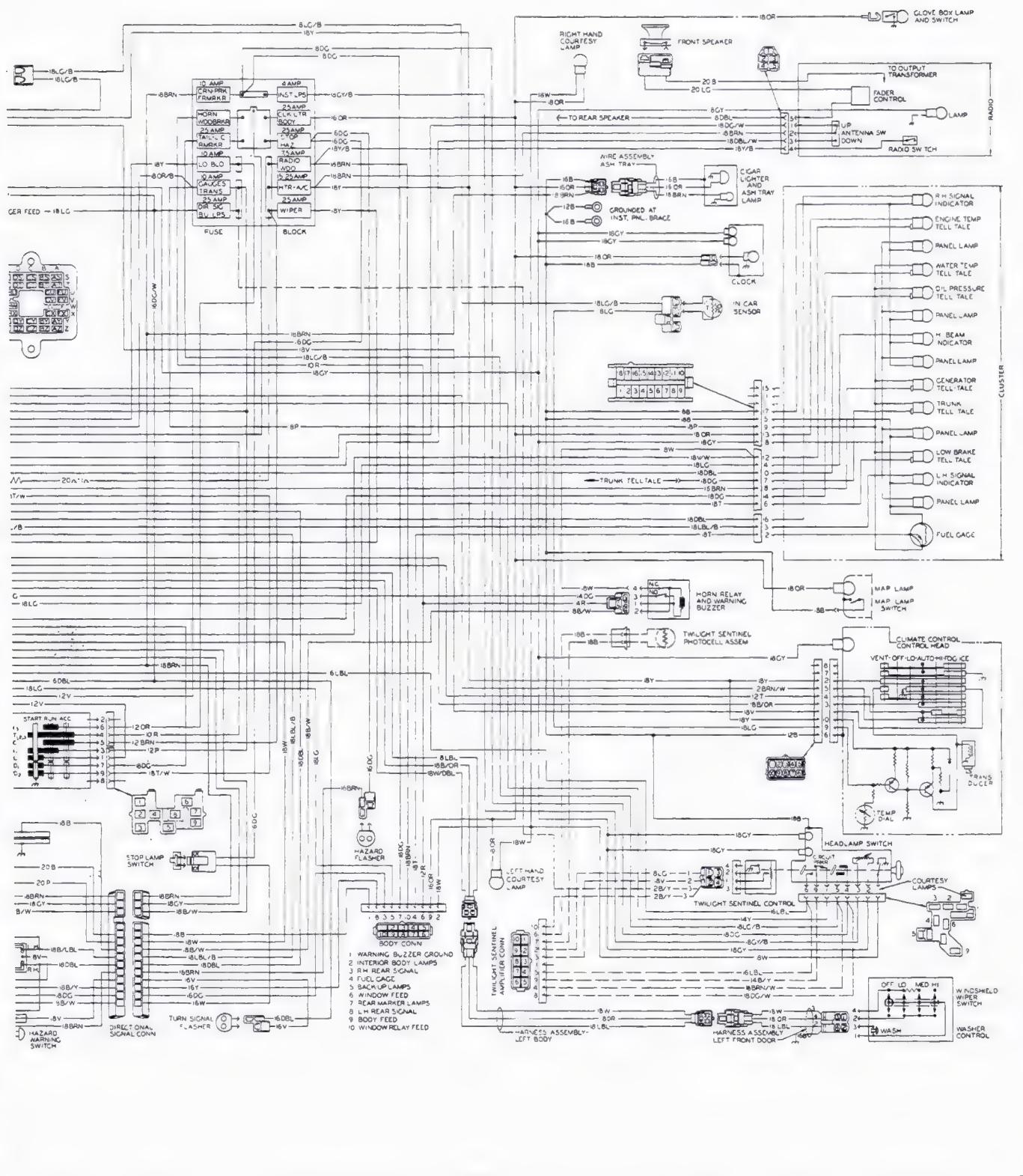


Fig. 12-48 Chassis Circuit Diagram (693)

CHASSIS ELECTRICAL

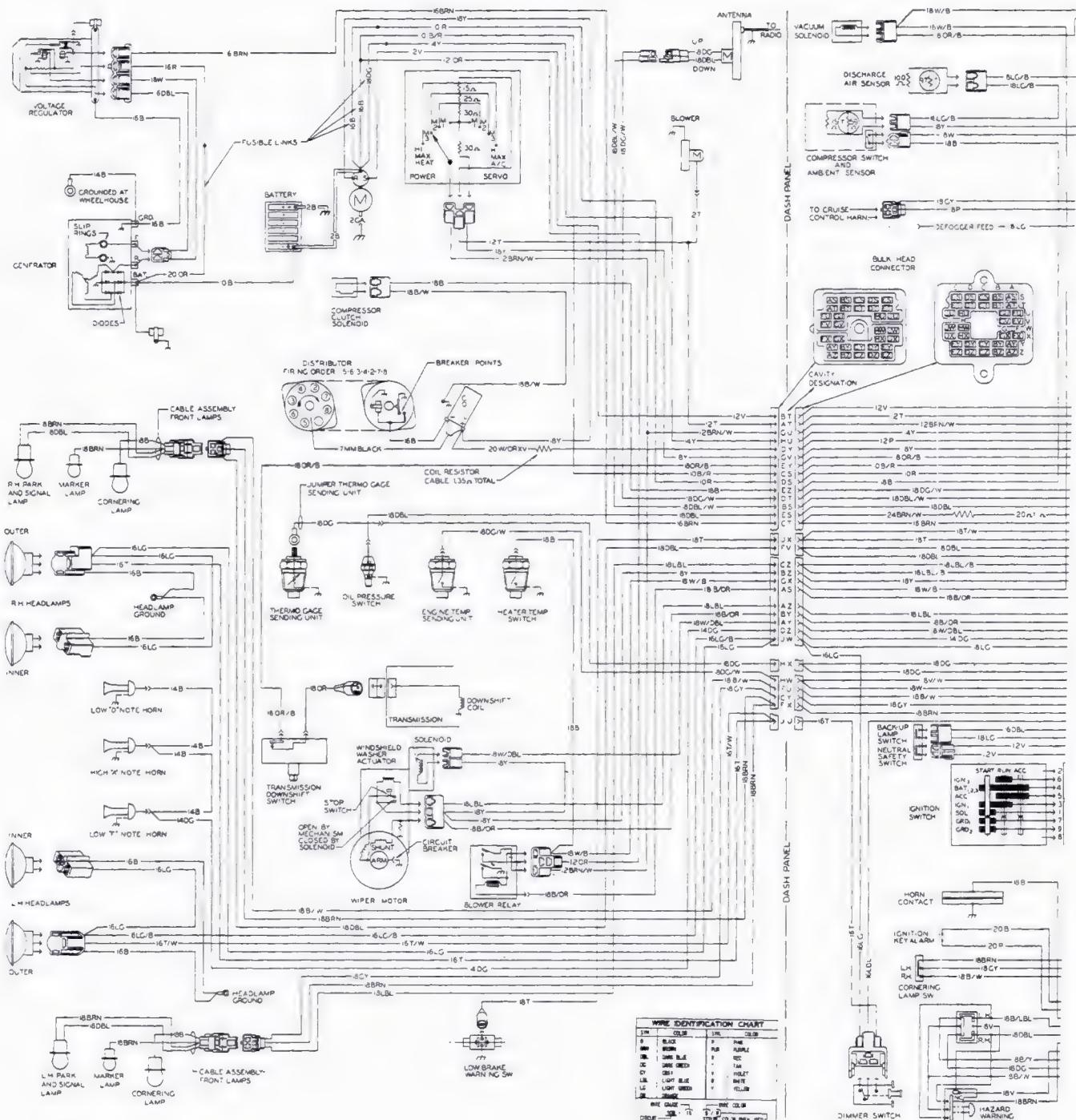


Fig. 12-49 Chassis Circuit Diagram (697)

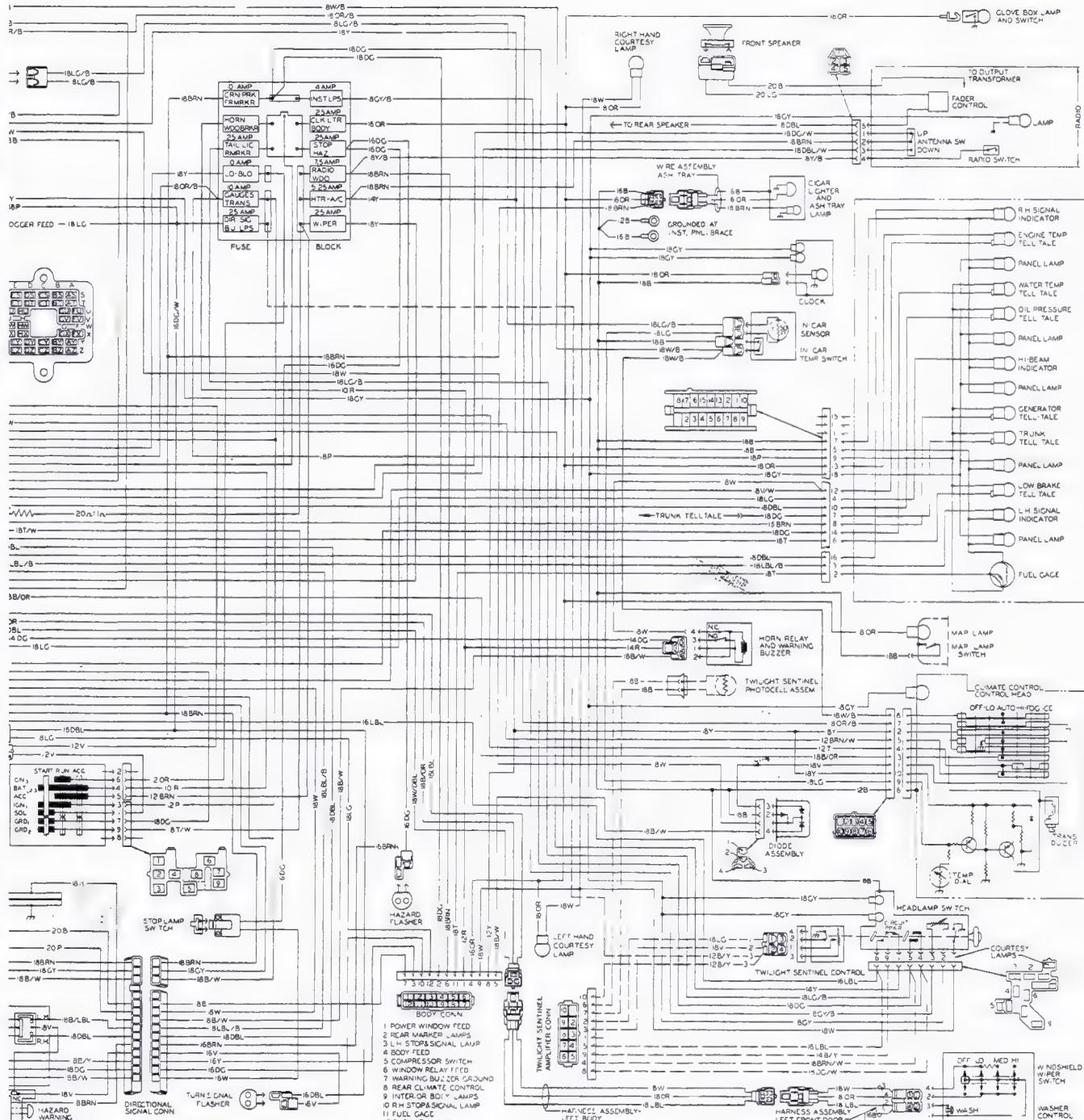


Fig. 12-49 Chassis Circuit Diagram (697)

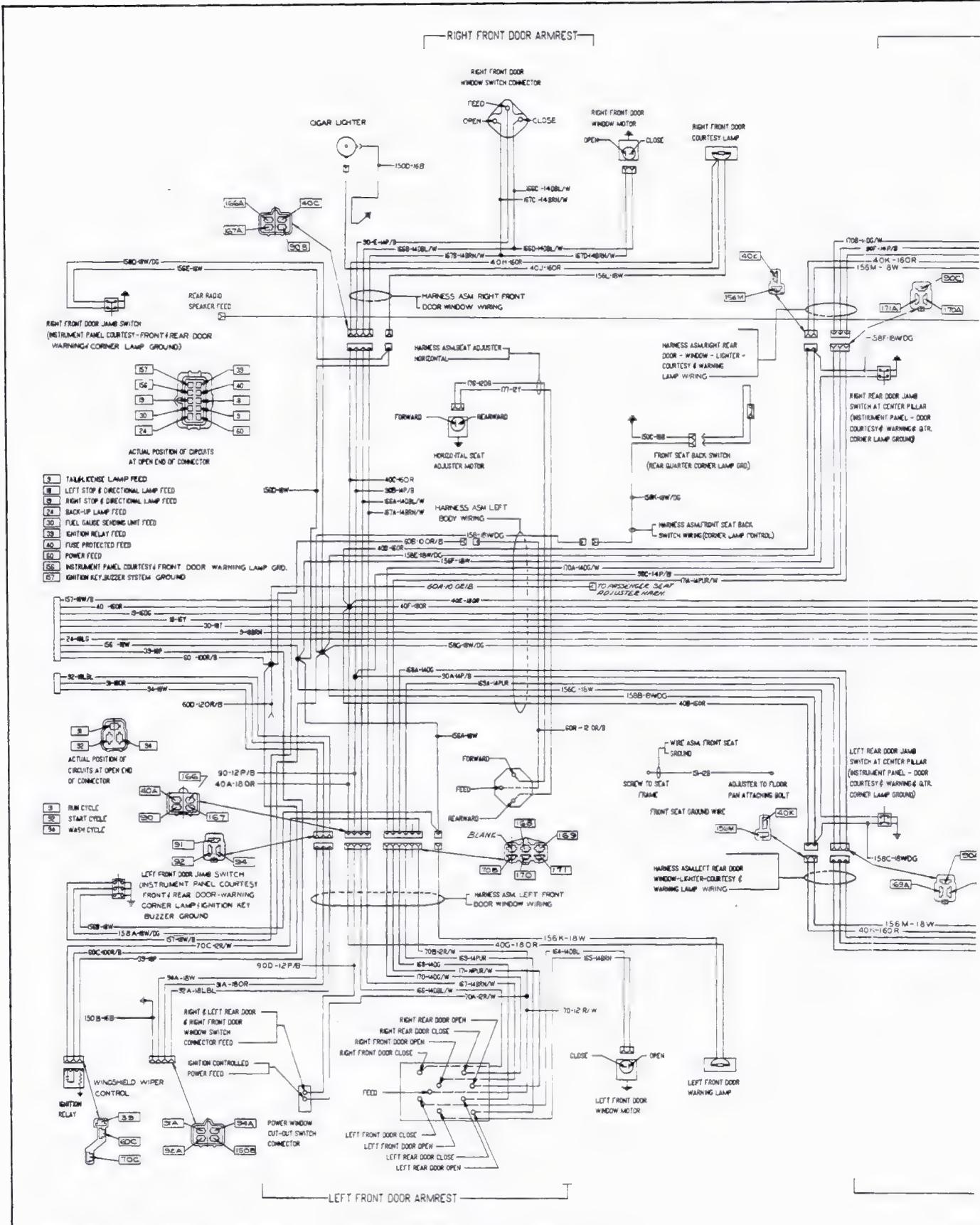


Fig. 12-50 Body Wiring Diagram (68069)

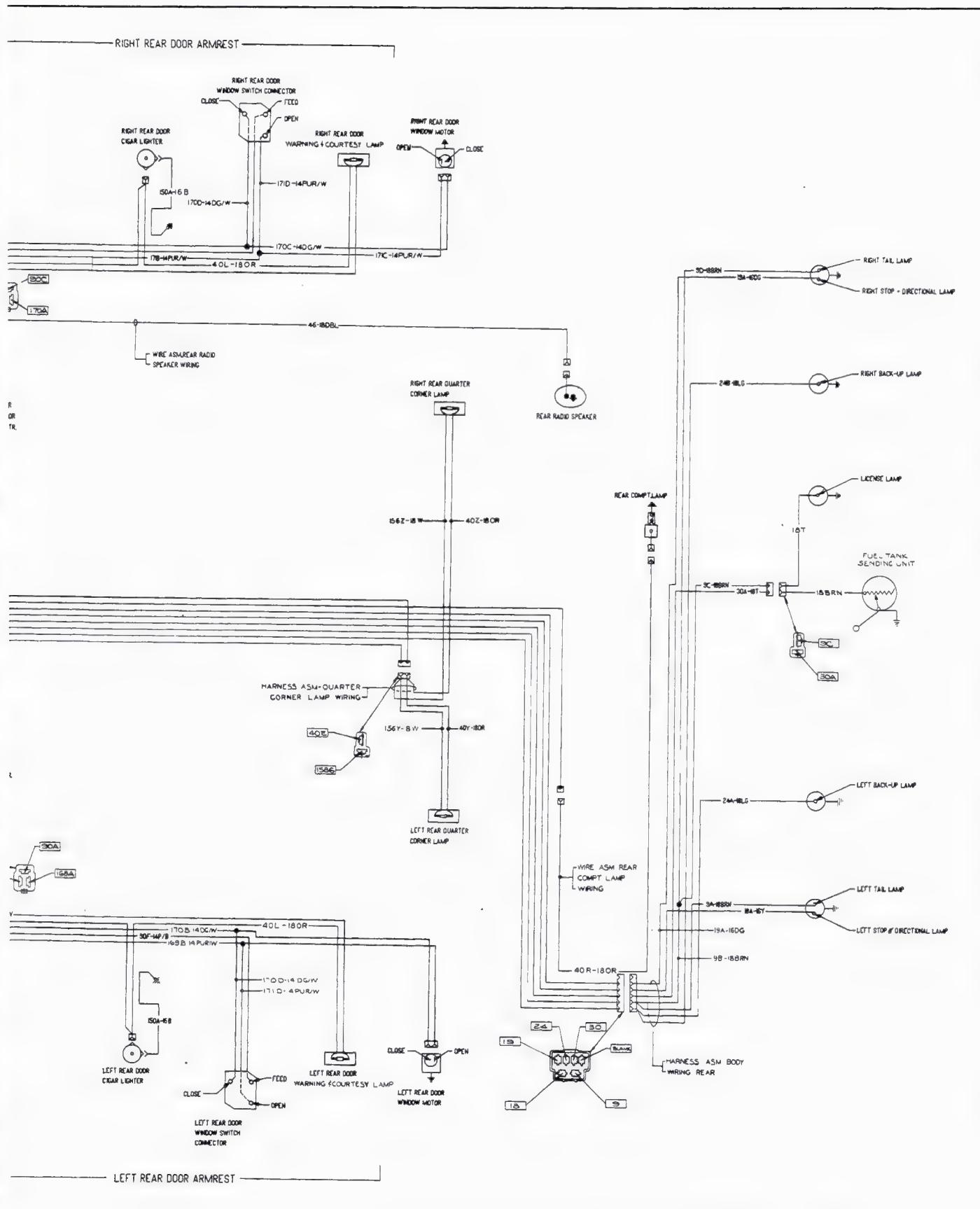


Fig. 12-50 Body Wiring Diagram (68069)

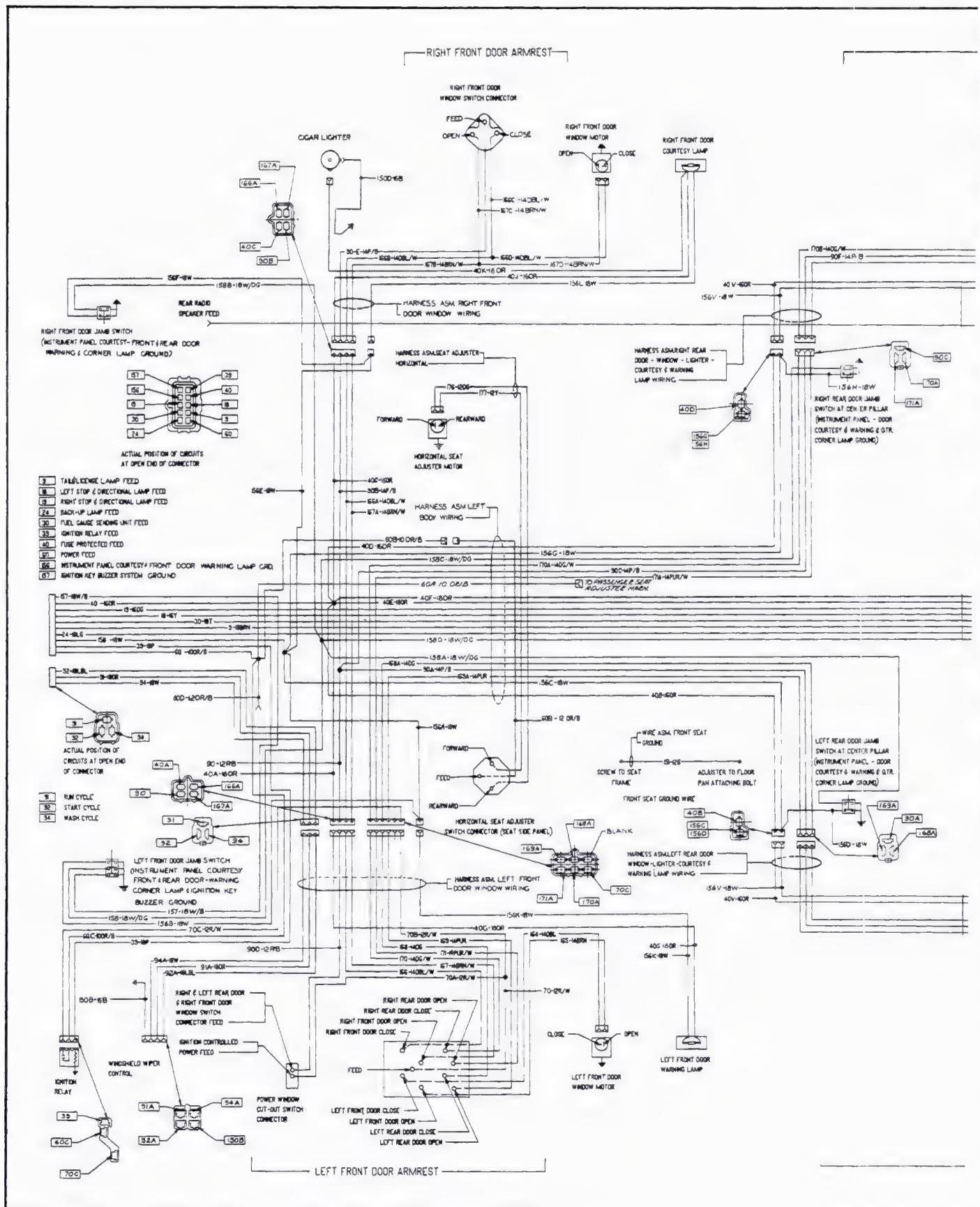


Fig. 12-51 Body Wiring Diagram (68169)

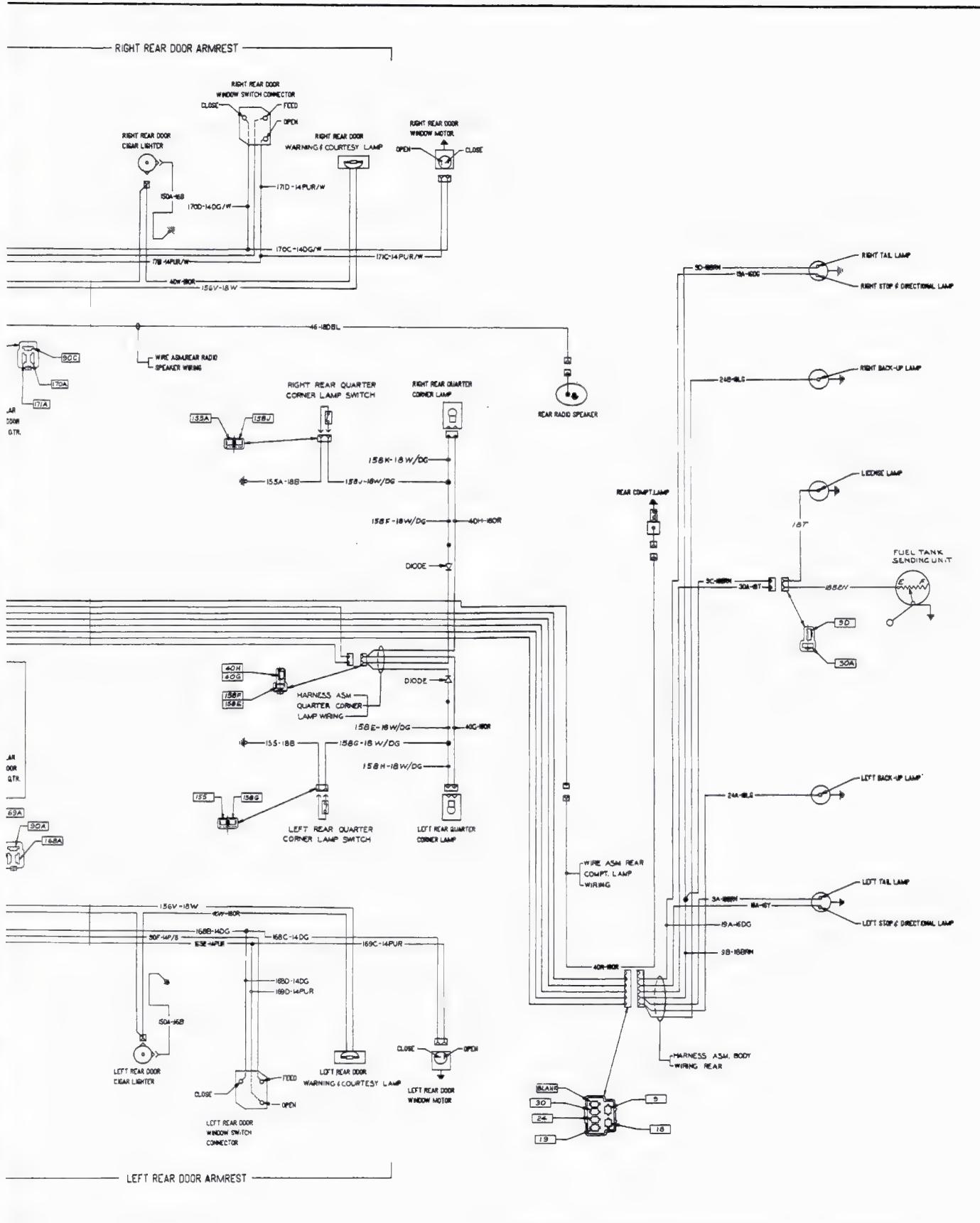


Fig. 12-51 Body Wiring Diagram (68169)

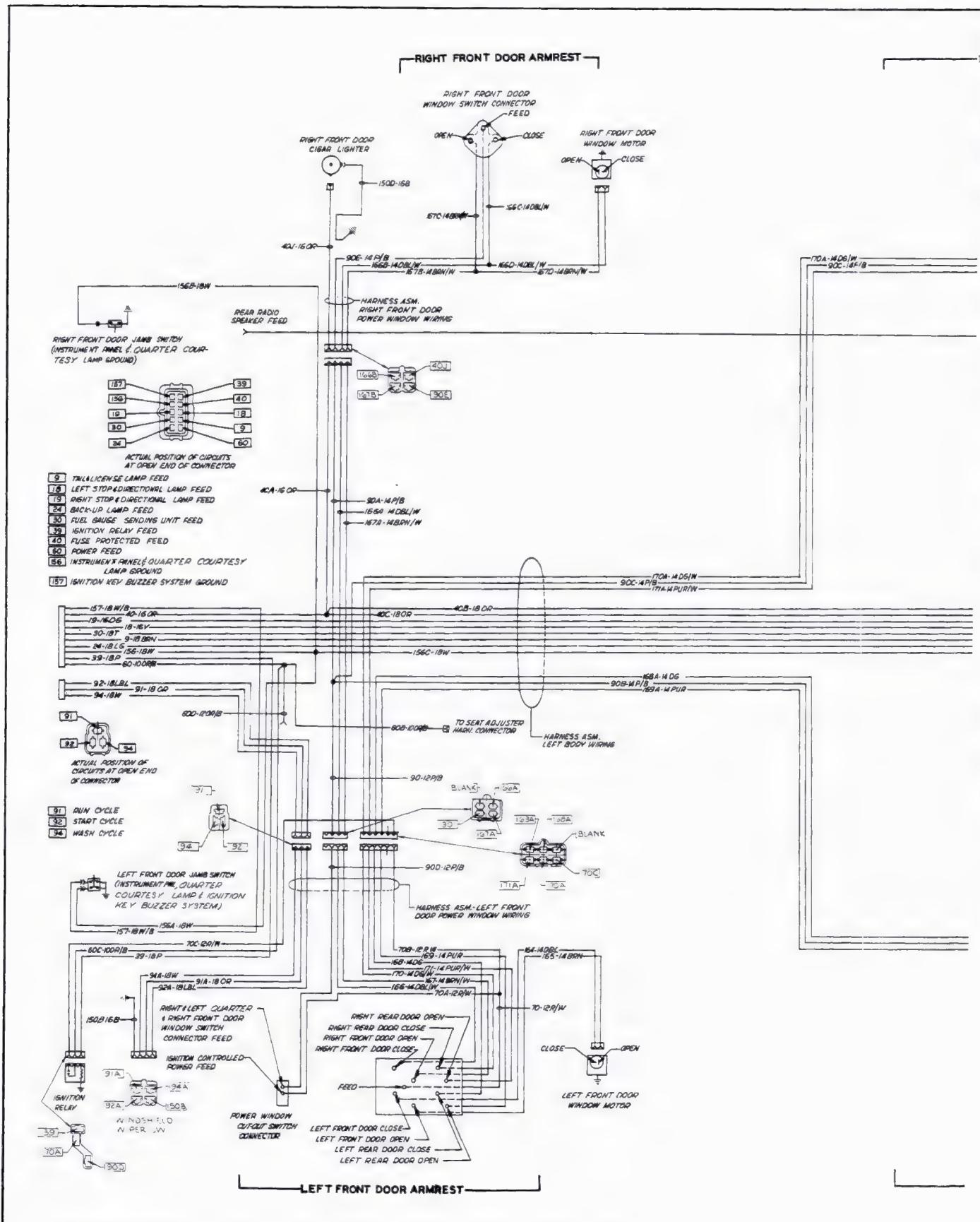


Fig. 12-52 Body Wiring Diagram (68247)

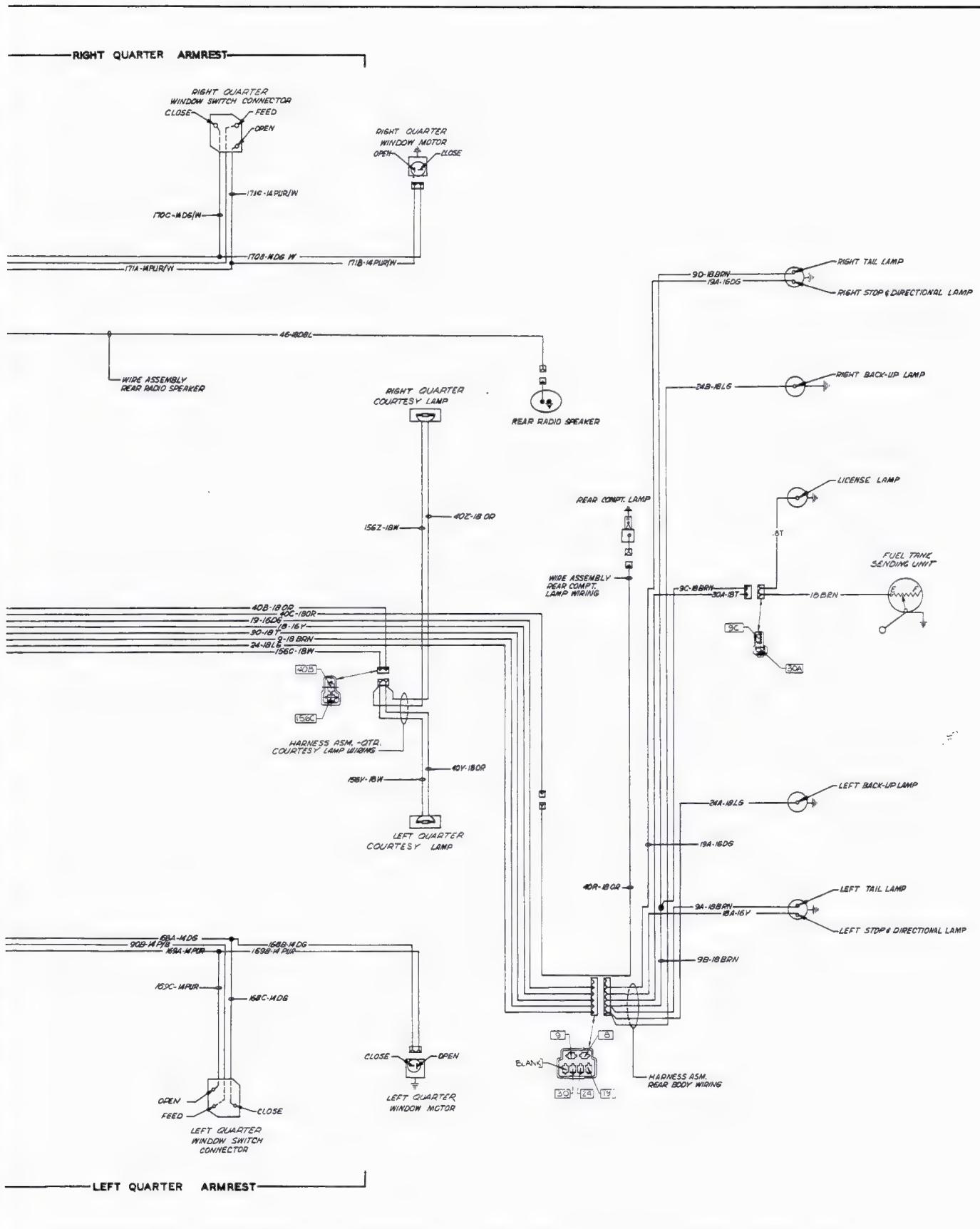


Fig. 12-52 Body Wiring Diagram (68247)

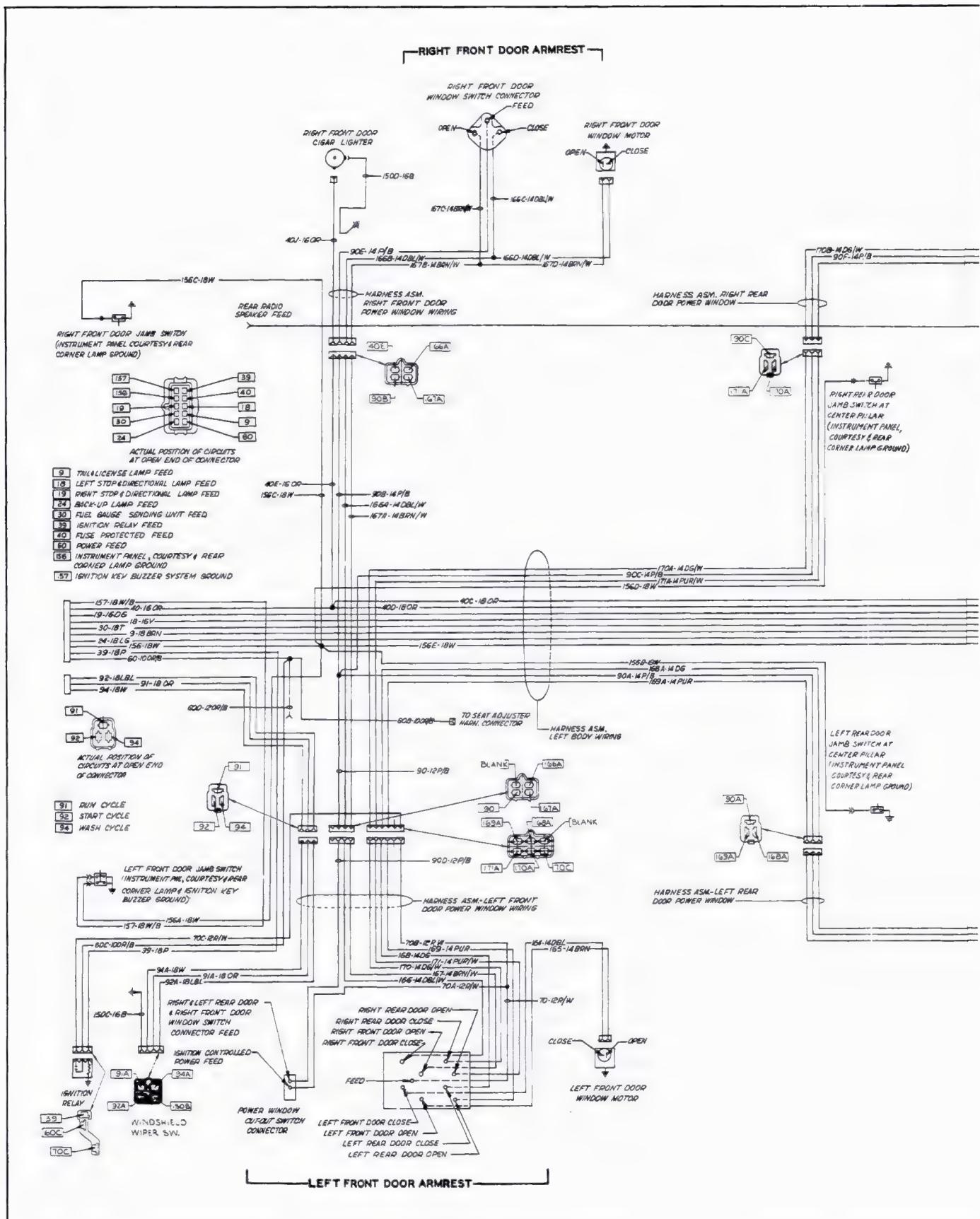


Fig. 12-53 Body Wiring Diagram (68249)

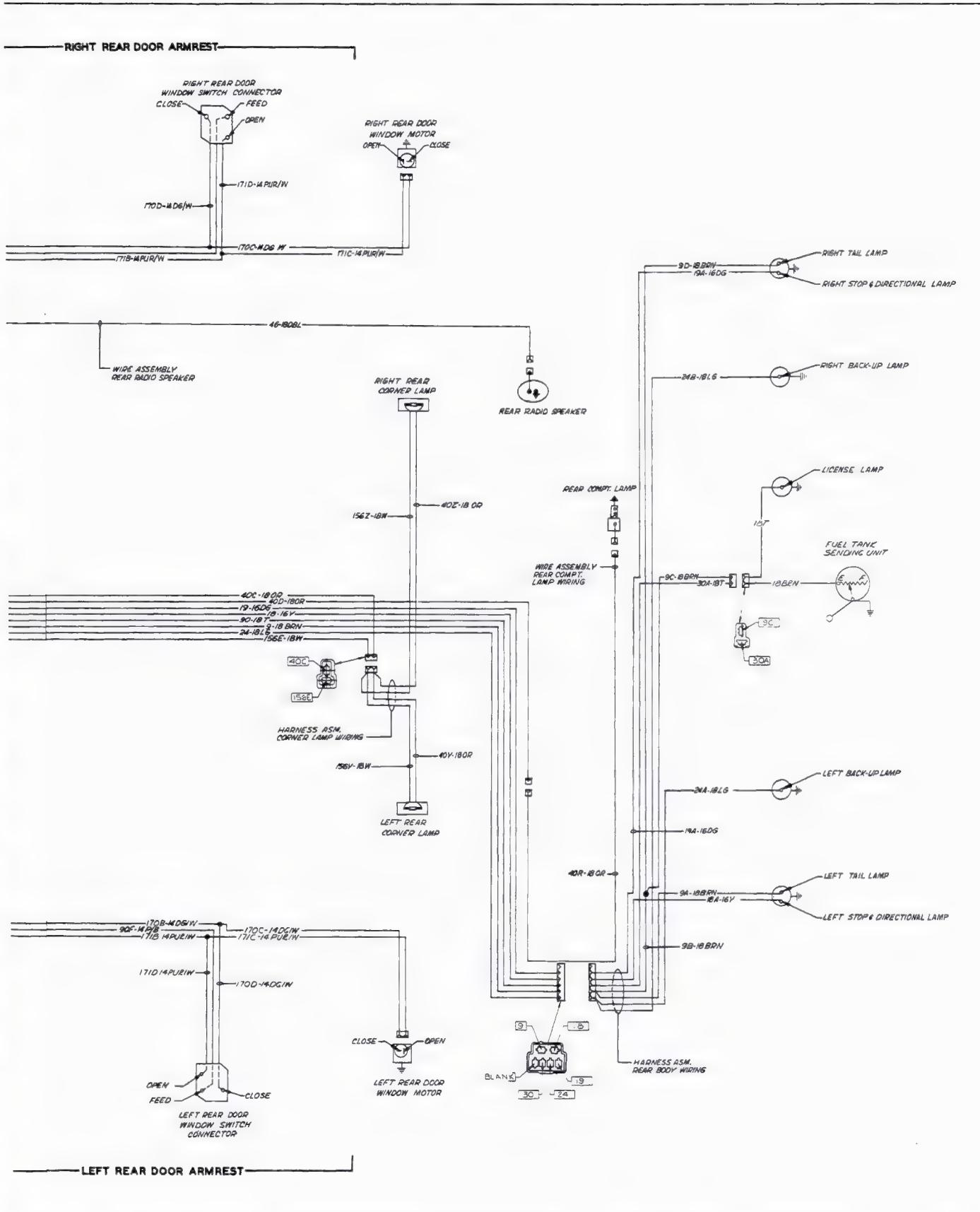


Fig. 12-53 Body Wiring Diagram (68249)

CHASSIS ELECTRICAL

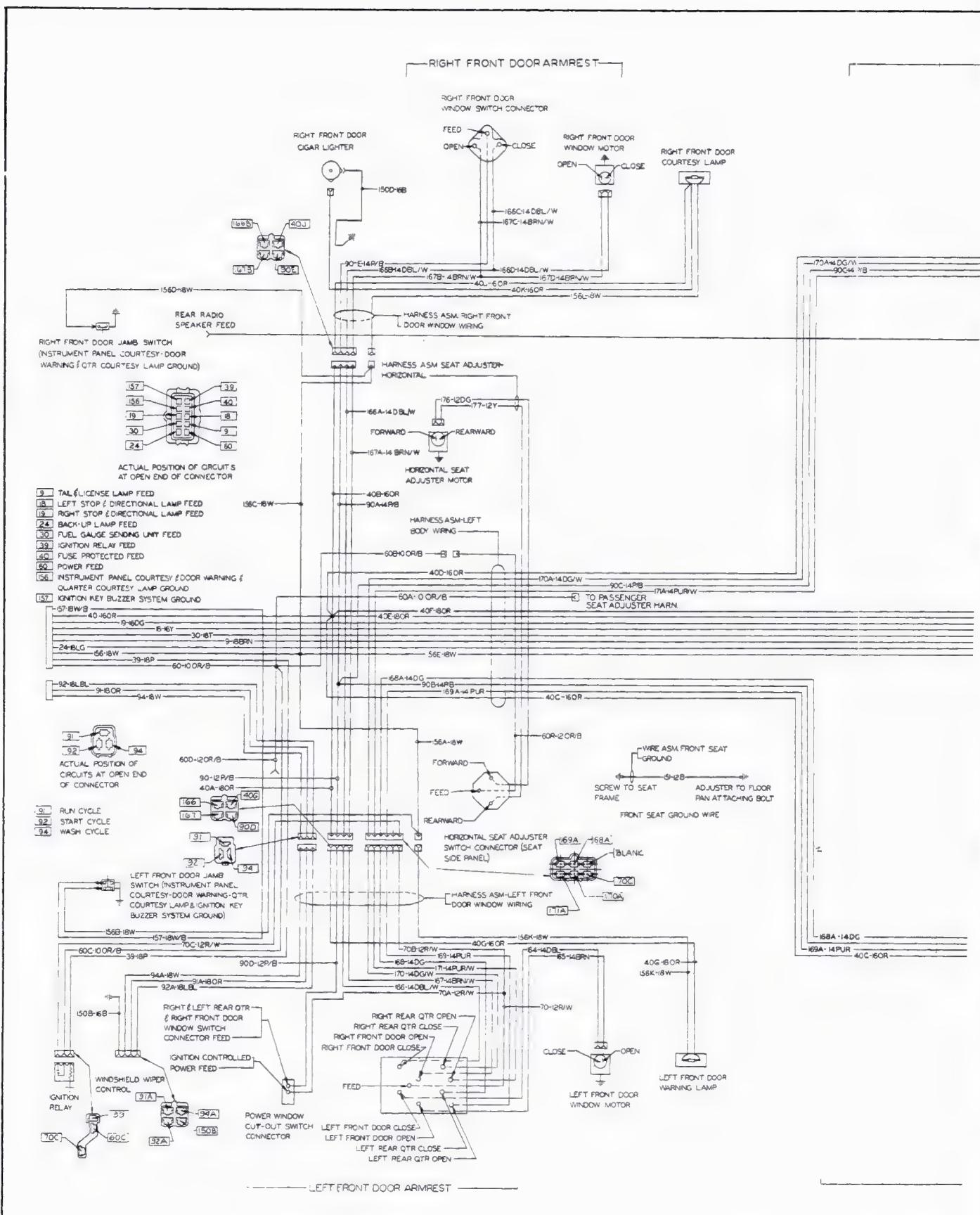


Fig. 12-54 Body Wiring Diagram (68347)

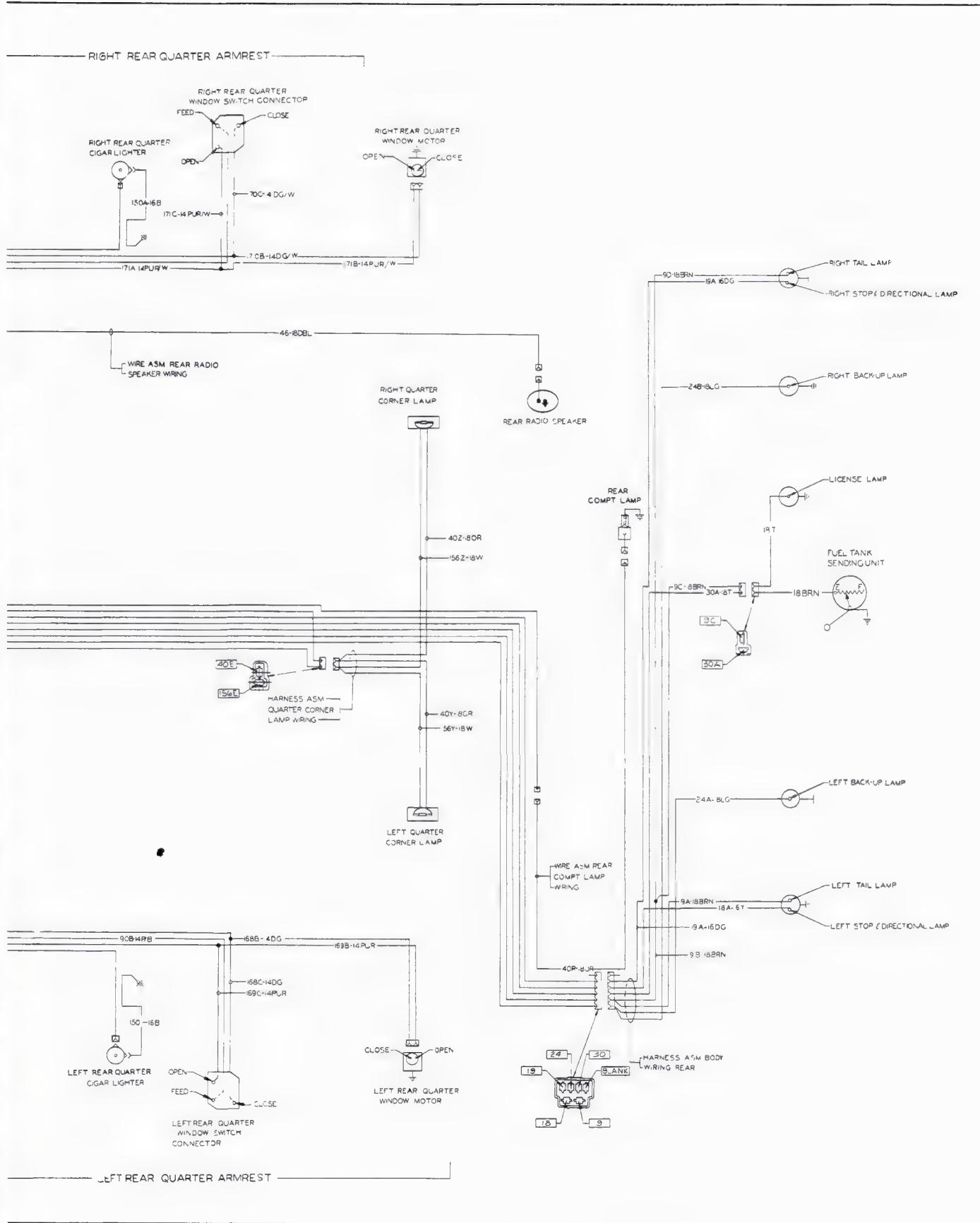


Fig. 12-54 Body Wiring Diagram (68347)

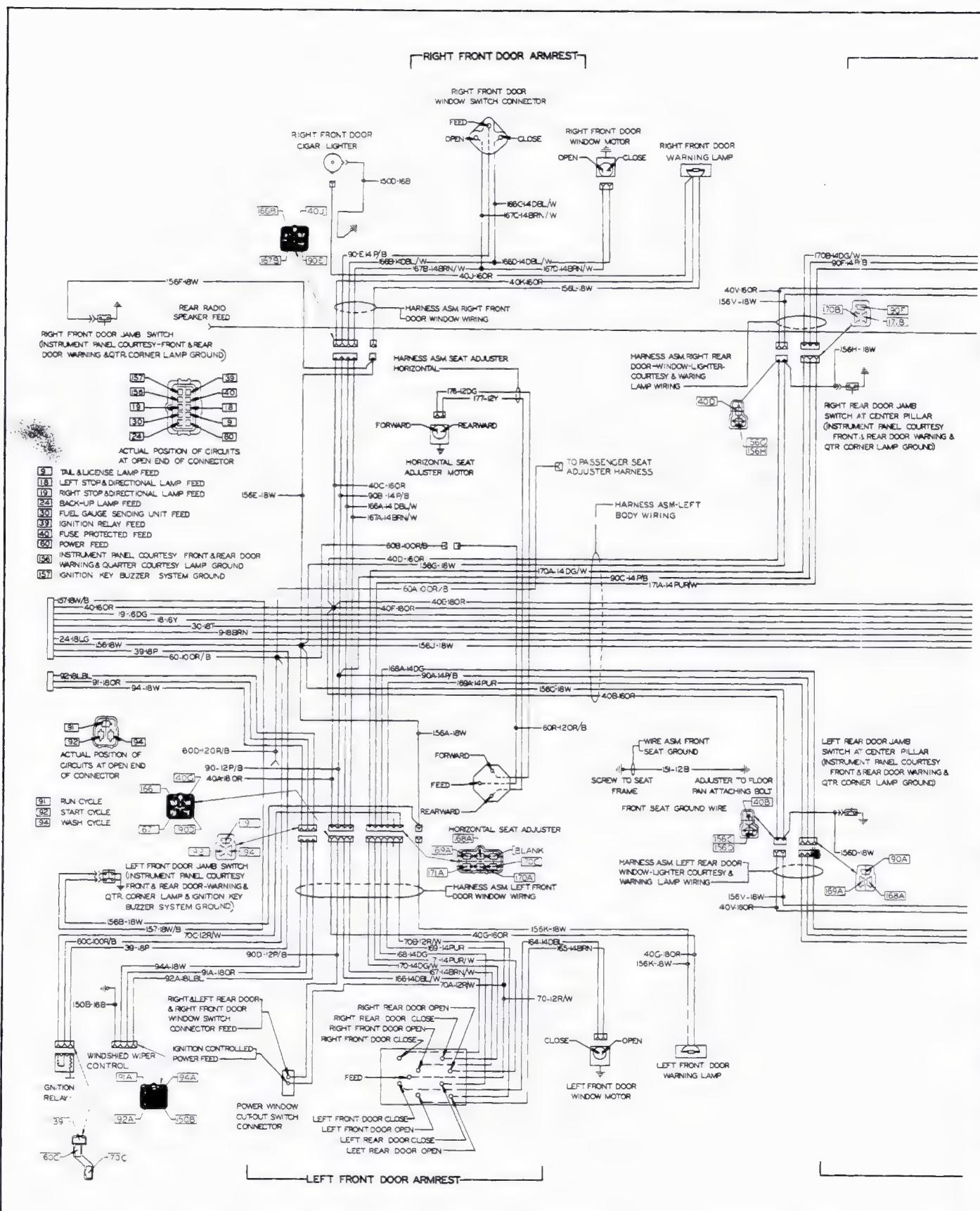


Fig. 12-55 Body Wiring Diagram (68349 and 68369)

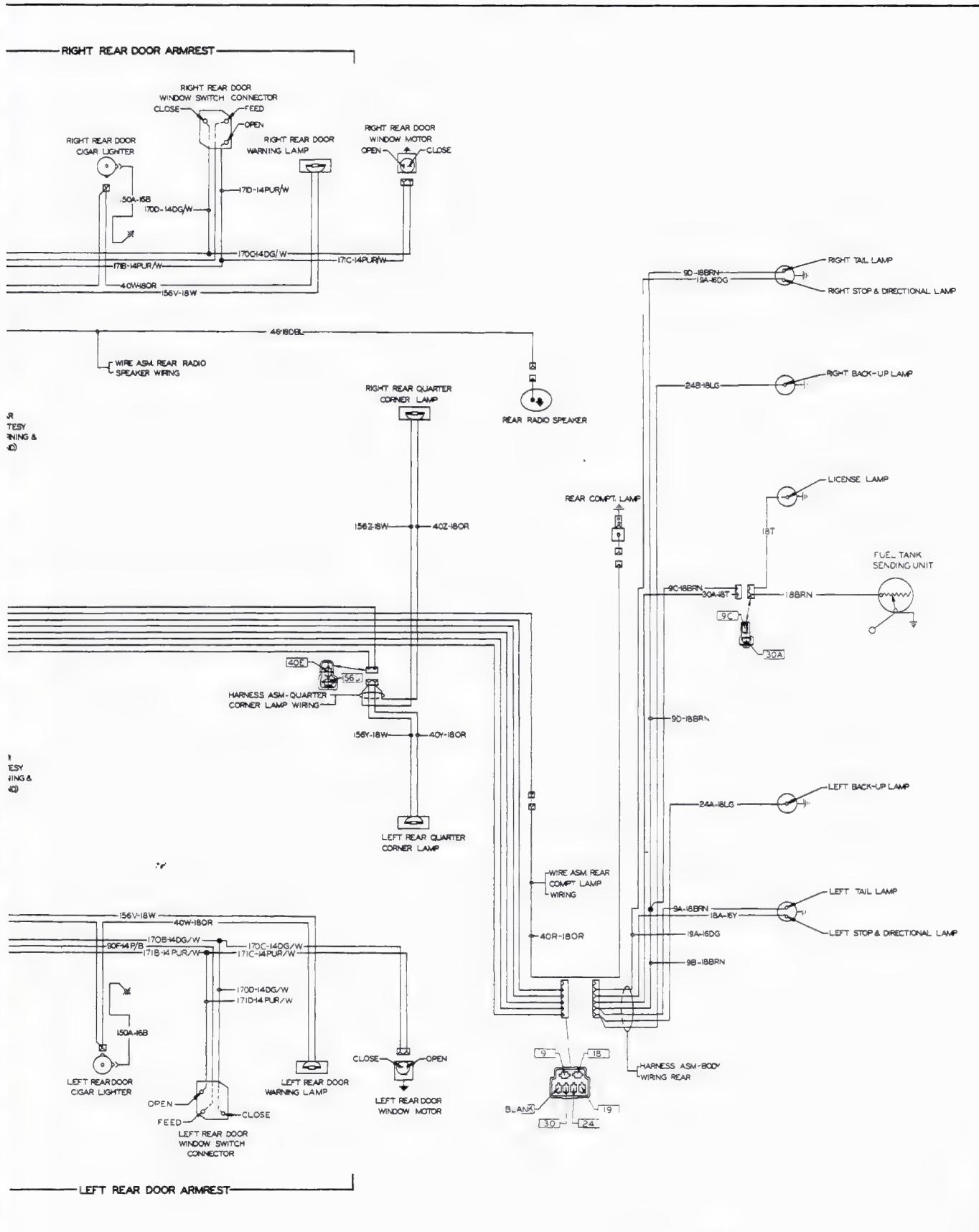


Fig. 12-55 Body Wiring Diagram (68349 and 68369)

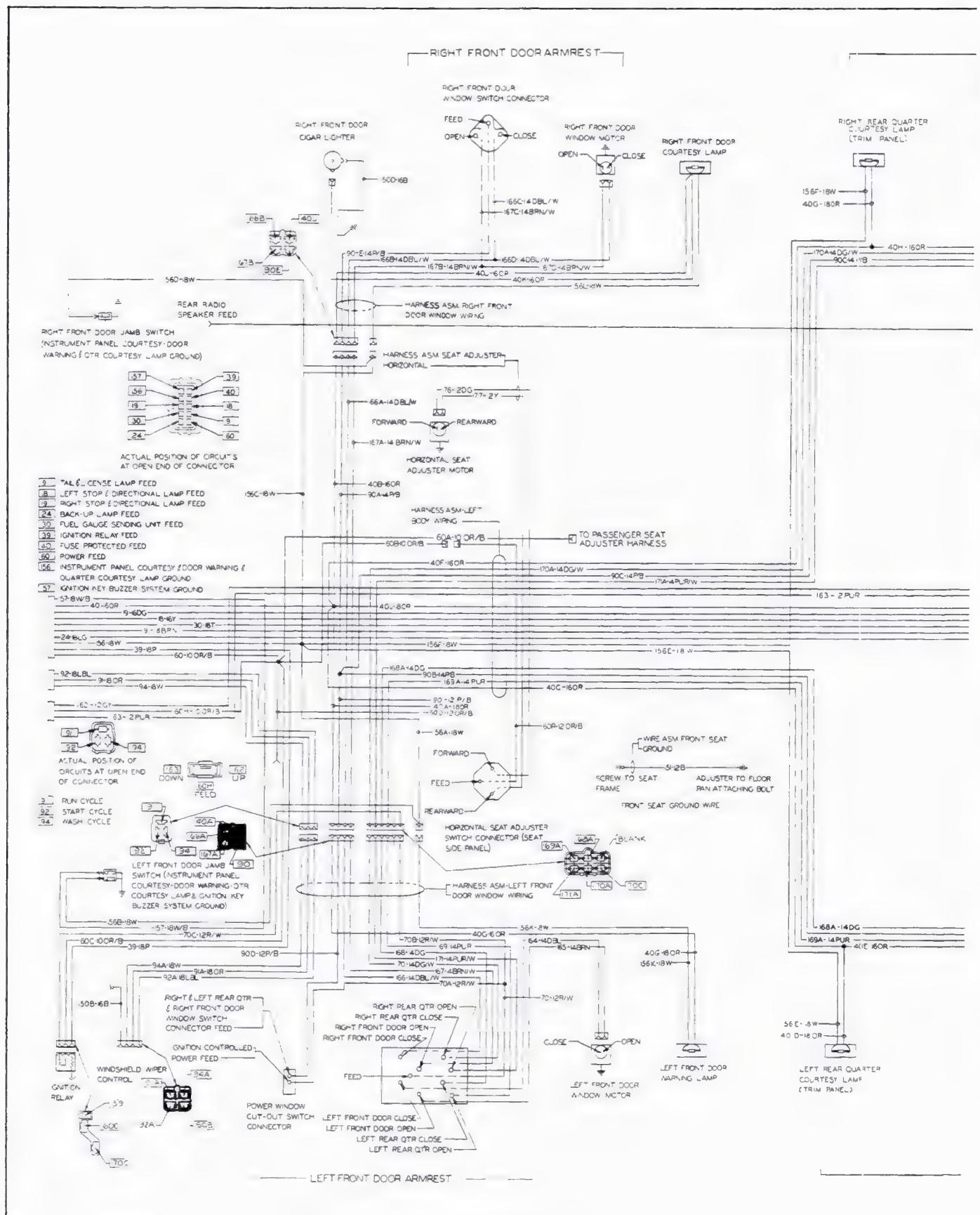


Fig. 12-56 Body Wiring Diagram (68367)

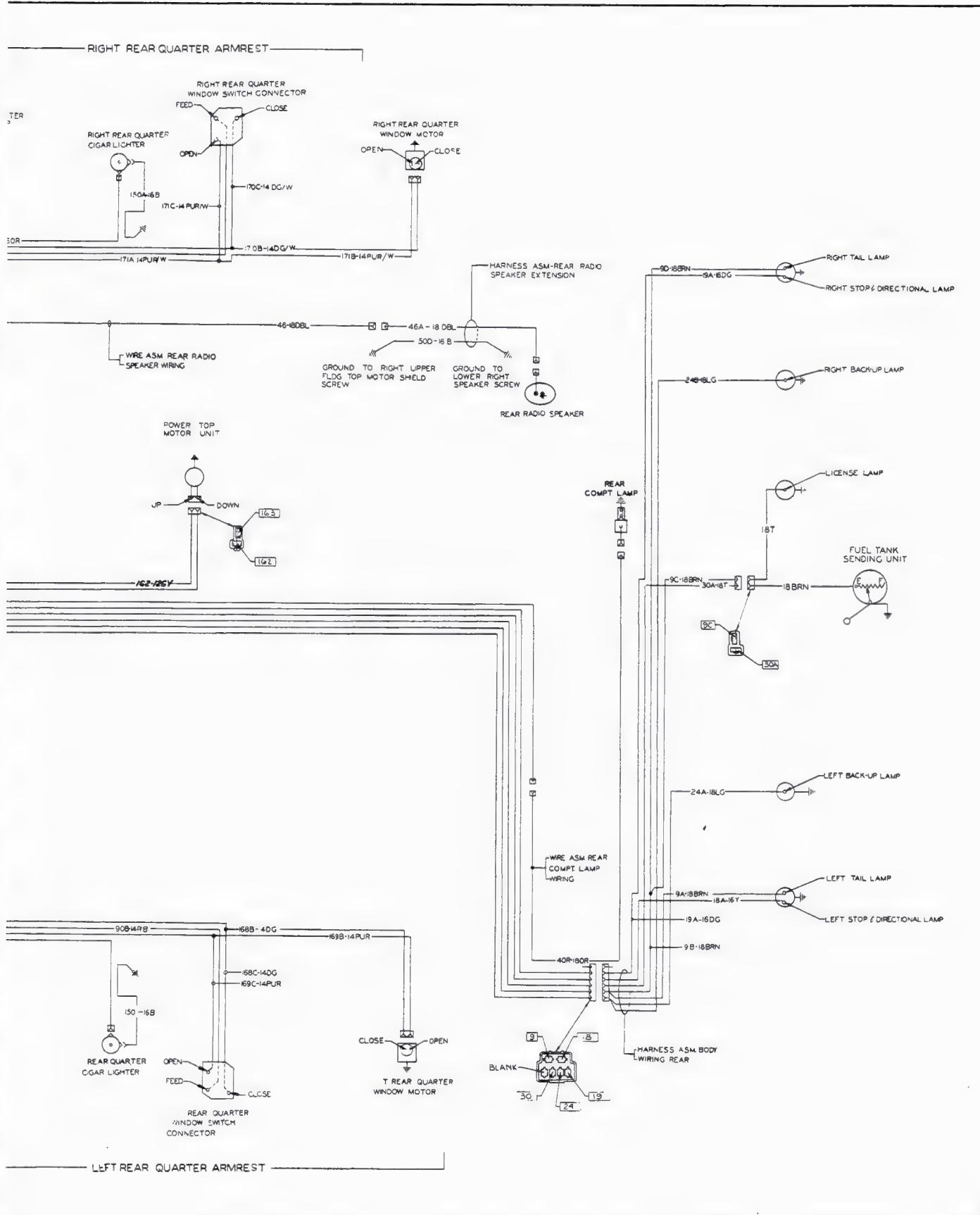


Fig. 12-56 Body Wiring Diagram (68367)

CHASSIS ELECTRICAL

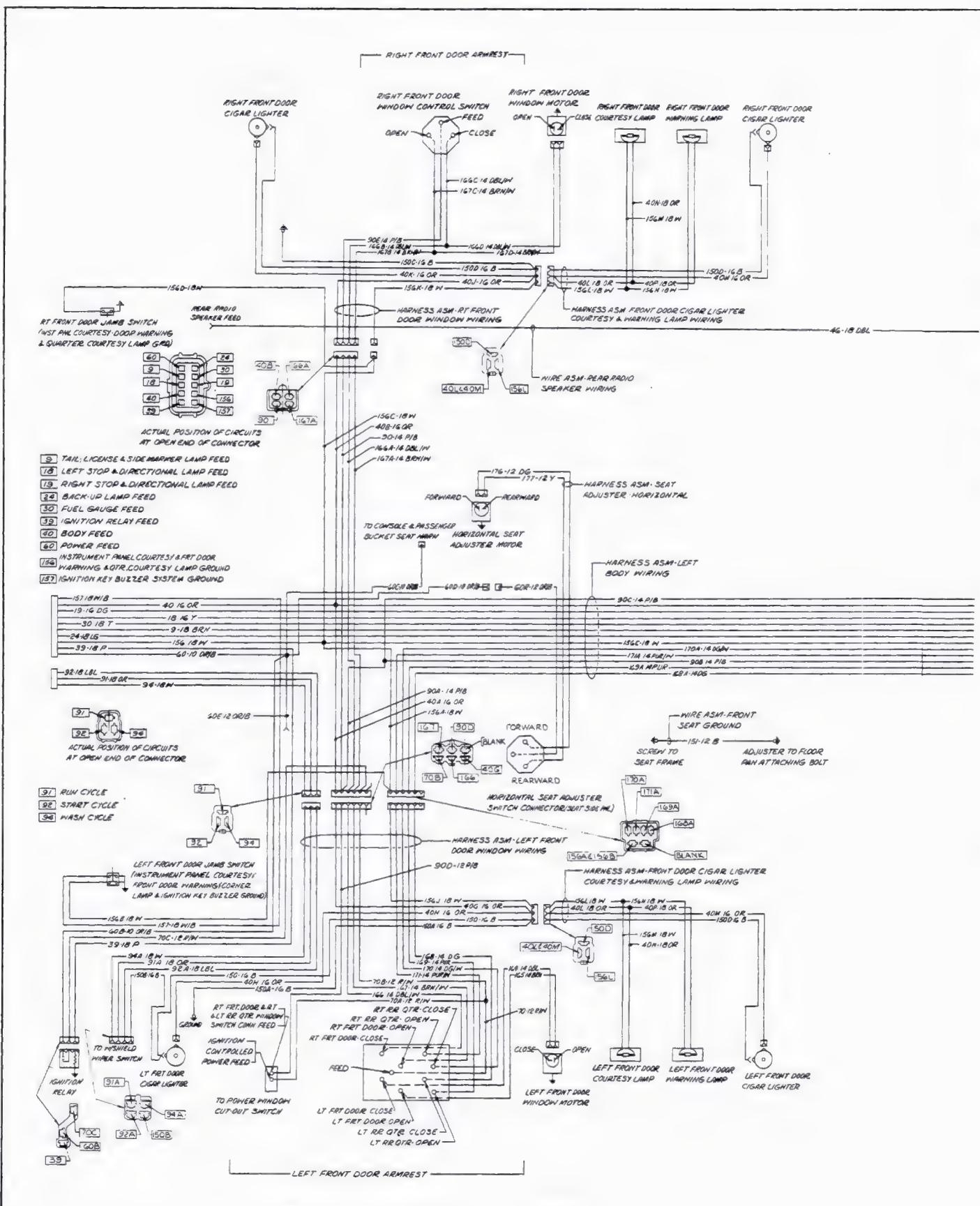


Fig. 12-57 Body Wiring Diagram (69347)

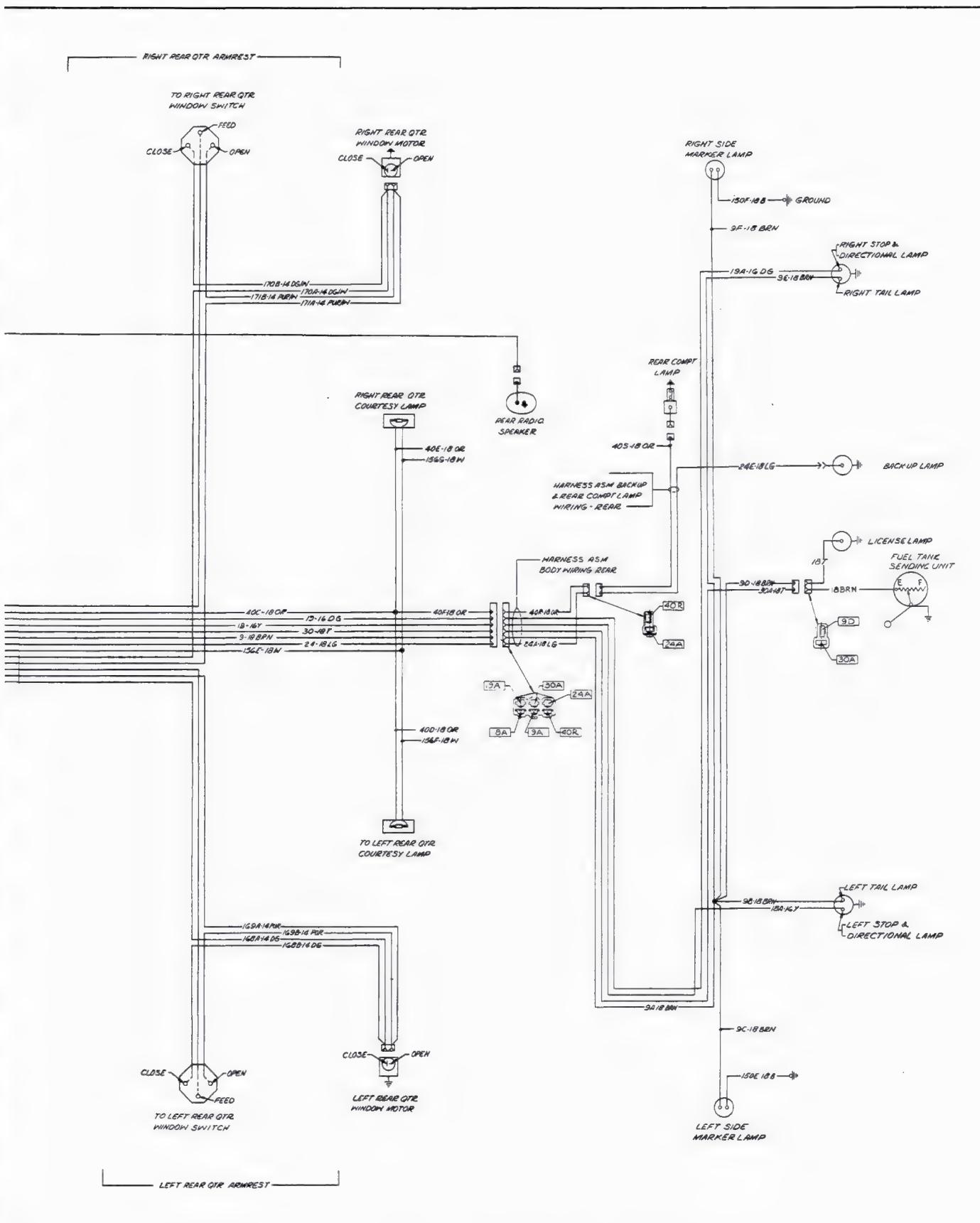


Fig. 12-57 Body Wiring Diagram (69347)

CHASSIS ELECTRICAL

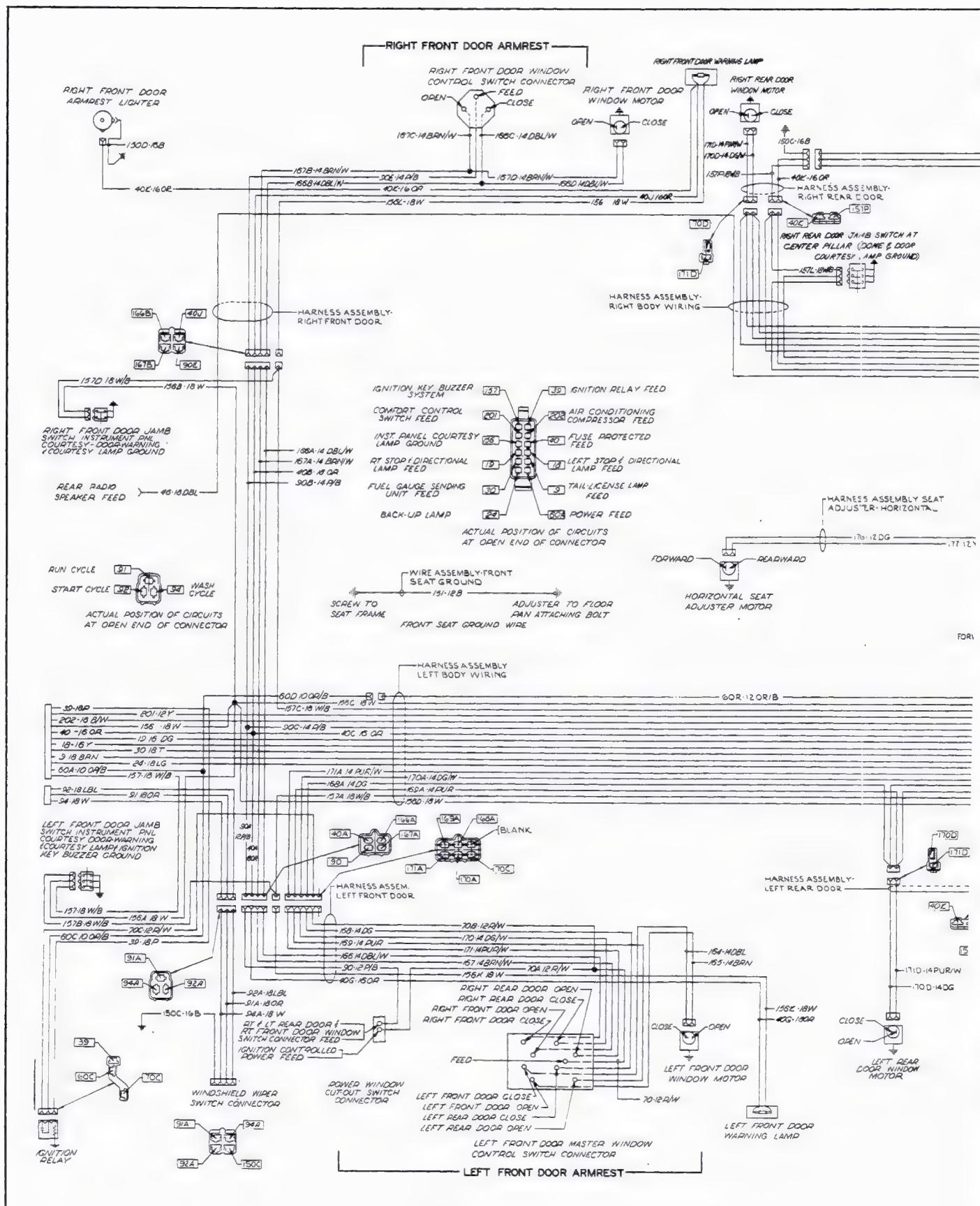


Fig. 12-58 Body Wiring Diagram (69723)

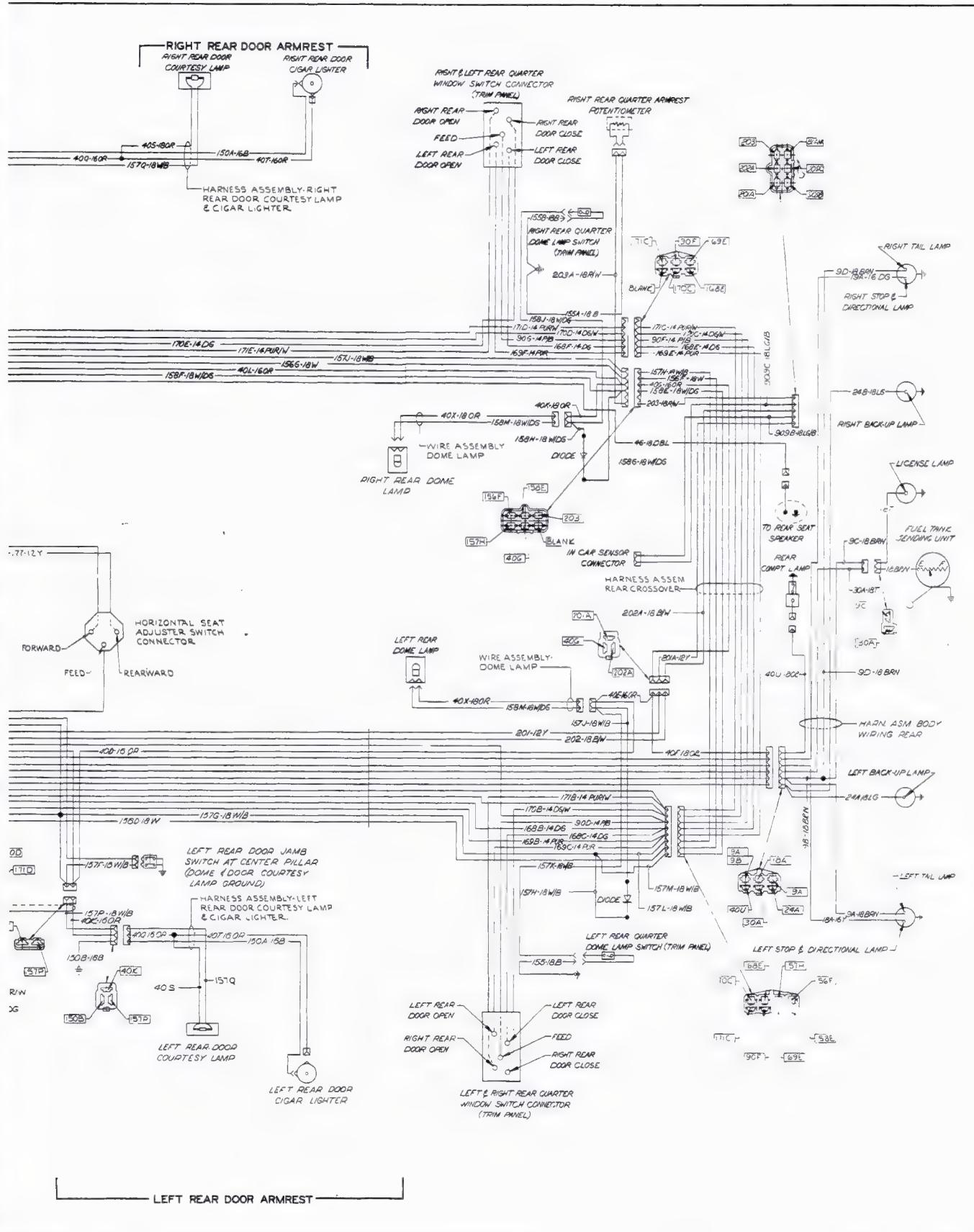


Fig. 12-58 Body Wiring Diagram (69723)

CHASSIS ELECTRICAL

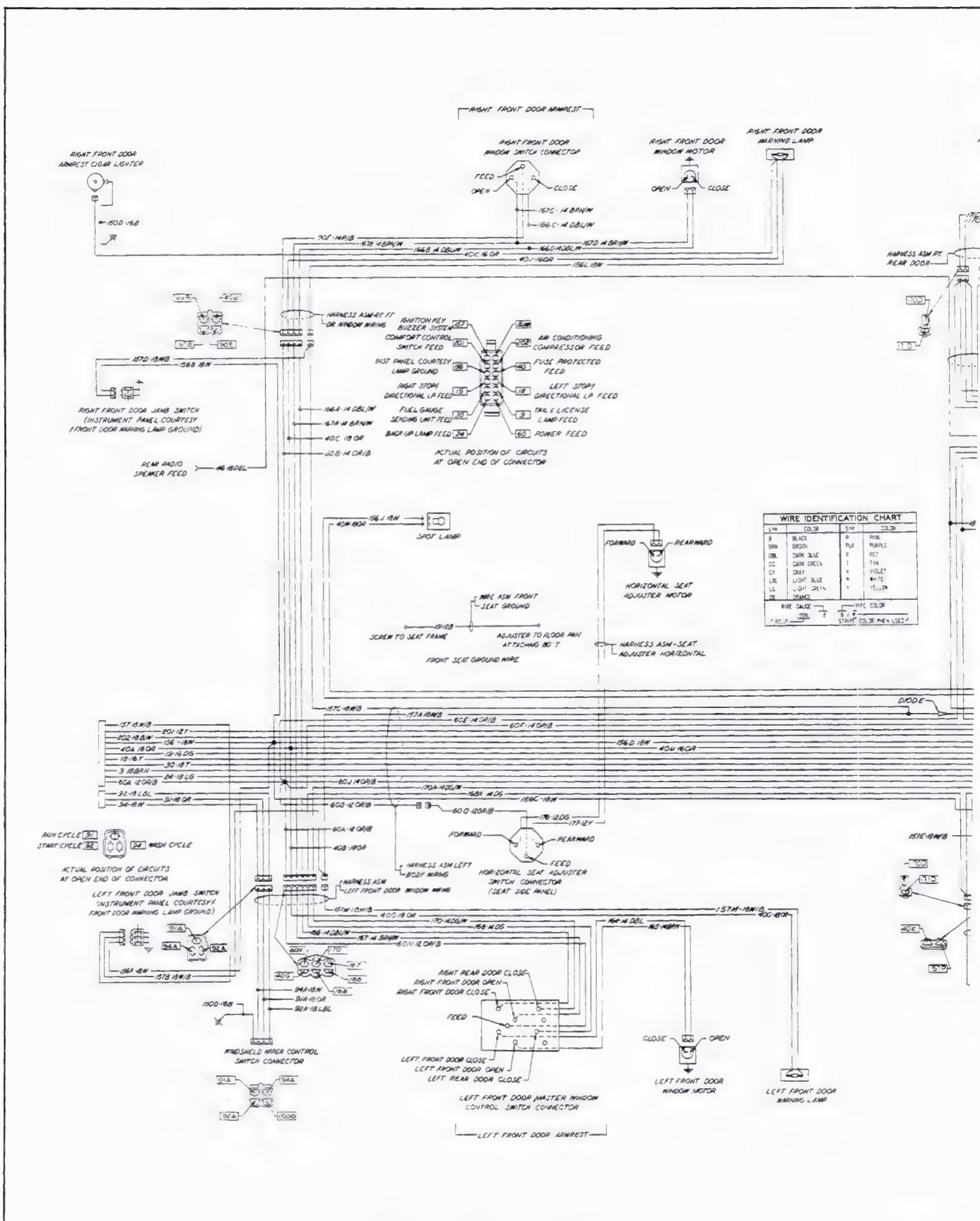


Fig. 12-59 Body Wiring Diagram (69733)

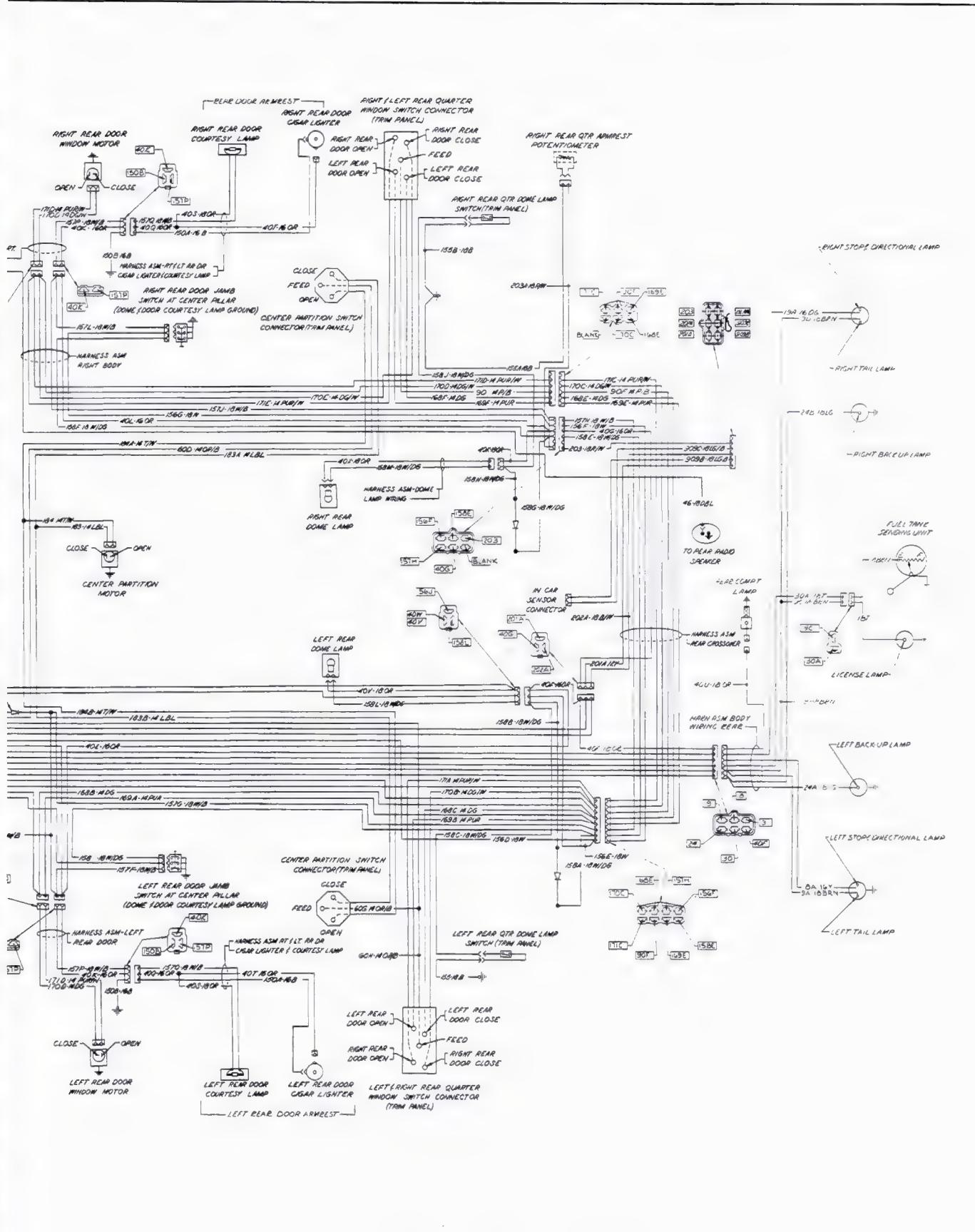


Fig. 12-59 Body Wiring Diagram (69733)

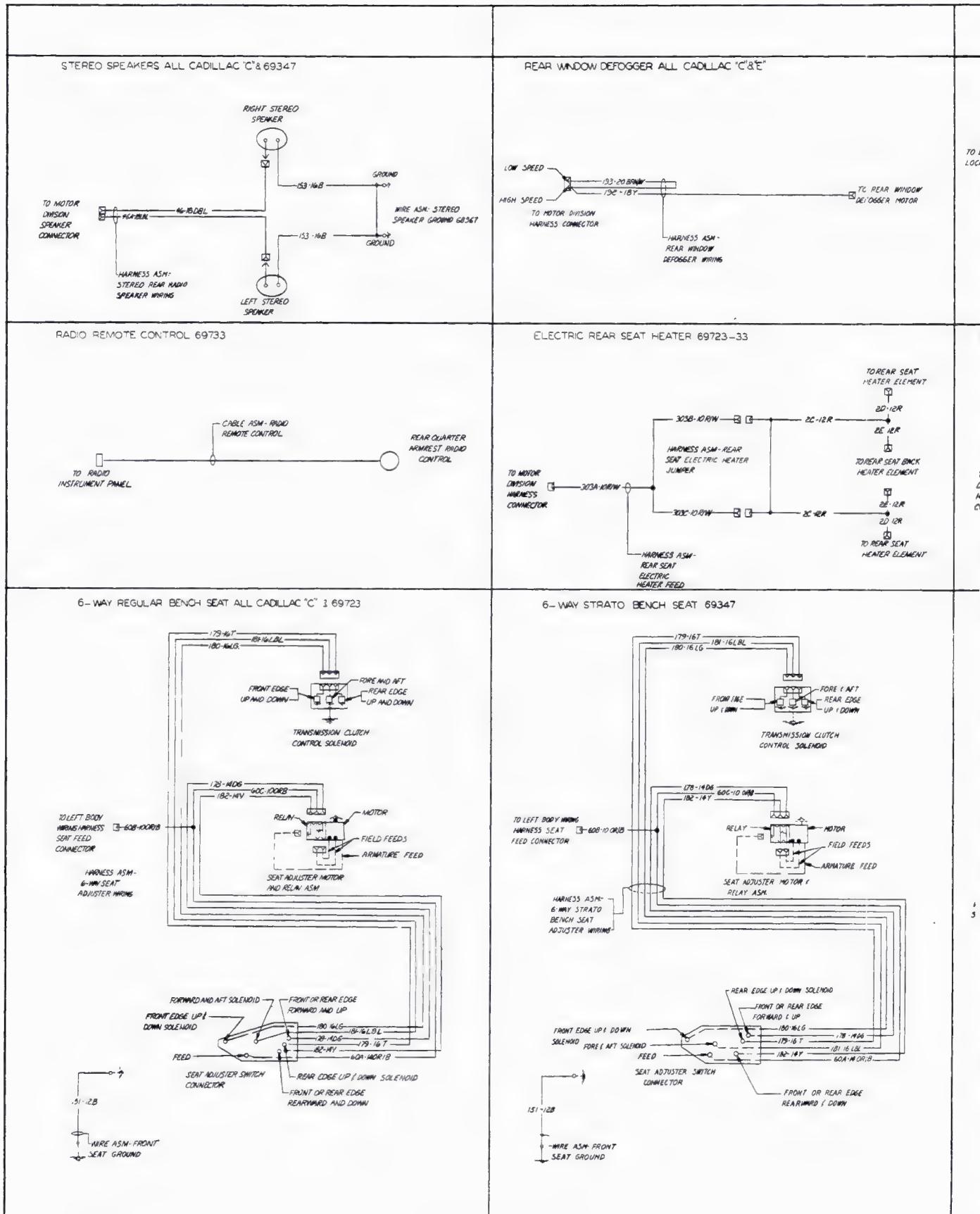


Fig. 12-60 Optional Body Wiring

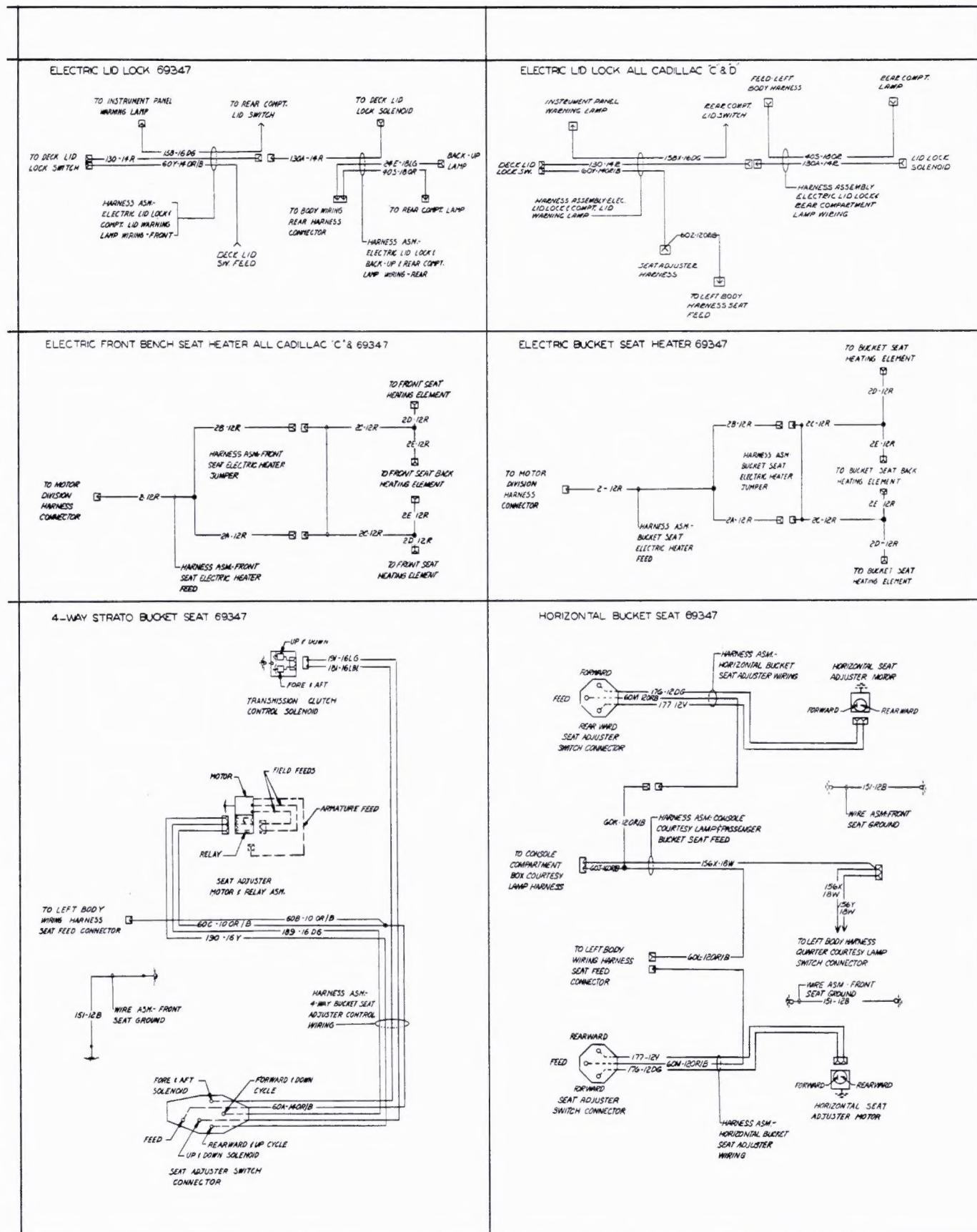


Fig. 12-60 Optional Body Wiring

CHASSIS ELECTRICAL

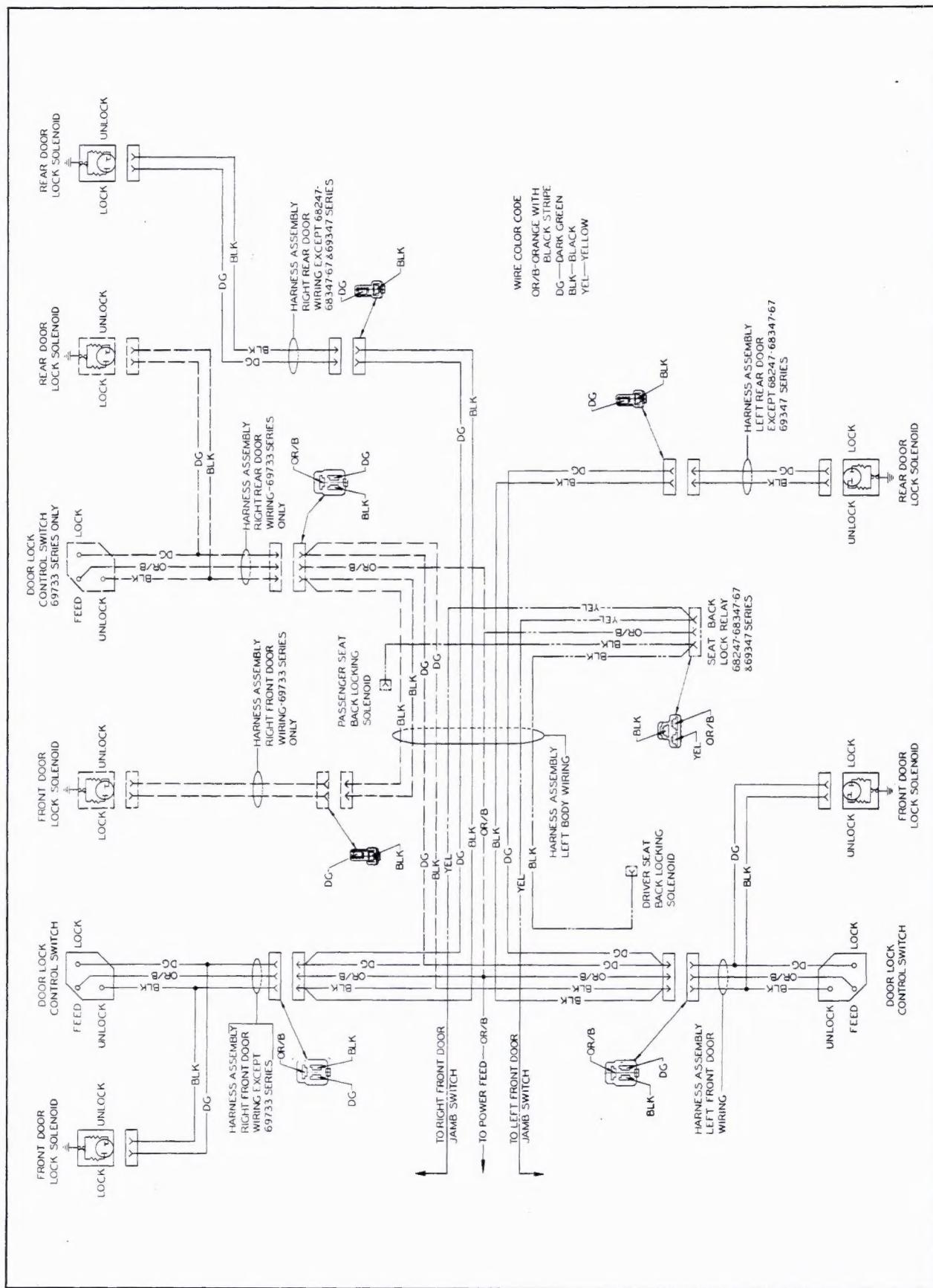


Fig. 12-61 Optional Electric Door Lock Wiring

FUSES

Unit	Fuse Rating
Body Feed	25 AMP.
Cigar Lighters	
Clock	
Courtesy Lights	
Glove Box Light	
Map Light	
*Reading Light, Chauffeur	
Trunk Light	
Cornering and Parking Lights	10 AMP.
Ash Tray Light	
Cornering Lights	
Front Side Marker Lights	
Parking Lights	
Cruise Control (Eldorado Only) (In-line behind left hand side of instrument cluster)	6 AMP.
Directional Signal and Back-up Lights	20 AMP.
Back-up Lights	
Cruise Control (Vacuum and Electric)	
Rear Window De-Fogger	
Turn Signals	
Gages and Transmission Controls	10 AMP.
Downshift Solenoid	
Fuel Gage	
Generator Light	
Low Oil Pressure Indicator	
Water Temperature Warning Light	
Guide-Matic (In-line above left kickpad)	4 AMP.
Headlights (Integral with headlight switch)	15 AMP. (CB)
Heater and Accessories	25 AMP.
Air Conditioning Amplifier	
Air Conditioning Blower Relay	
Antenna	
Heater Blower	
(On cars equipped with a heater only, the 25 AMP fuse is replaced by a 15 AMP. fuse)	
Horns	(CB)
Convertible Top	
Horns	
Power Seat	
Power Windows	
Instrument Panel Lights	4 AMP.
Low Blower (Air Conditioning Only)	10 AMP.
Radio and Window Control Relay	7 1/2 AMP.
Stop Lights and Hazard Warning Flasher	25 AMP.
Tail Lights	25 AMP.
License Light	
Rear Side Marker Lights (Eldorado)	
Tail Lights	
Twilight Sentinel (Integral with headlight switch)	15 AMP. (CB)
Windshield Wipers	25 AMP.
Do not use fuses of higher amperage ratings than those recommended above.	
AMP. - Ampere	(CB) - Circuit Breaker
*Fleetwood Seventy-Five Limousine Only	

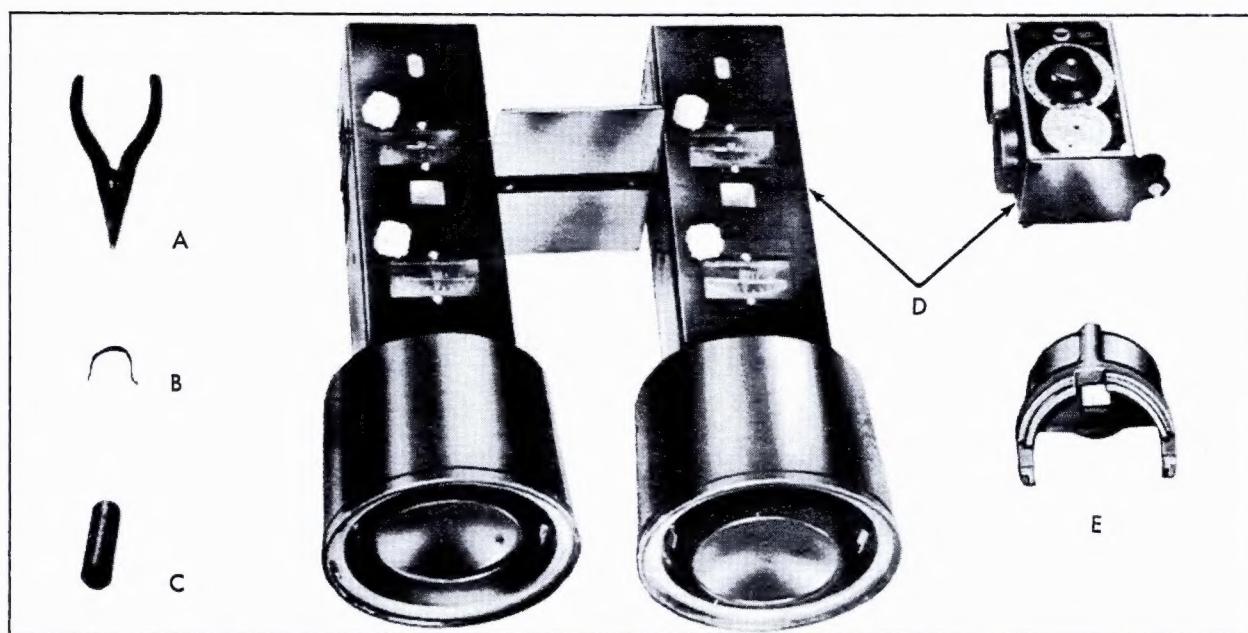


Fig. 12-62 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-4880	Snap Ring Pliers	D	J-6878-01	Headlight Aimer Set
B	J-7890	Brush Retainer Spring	E	J-21518-01	Float Tank Unit Wrench
C	J-6968	Spanner Nut Wrench			